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The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

$2.00 a year 20 cents a copy
Vol. XVII. No. 8

AUGUST 1920

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

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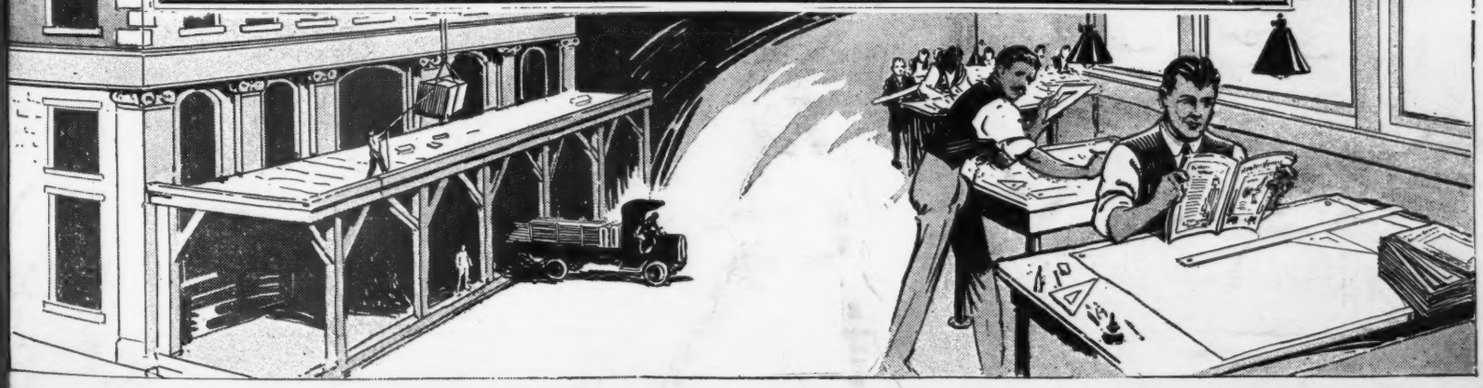

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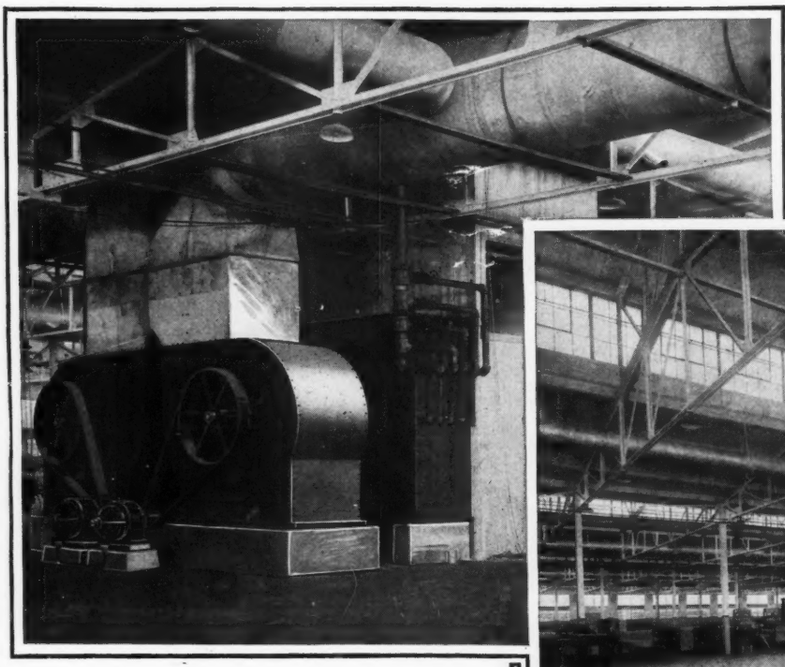

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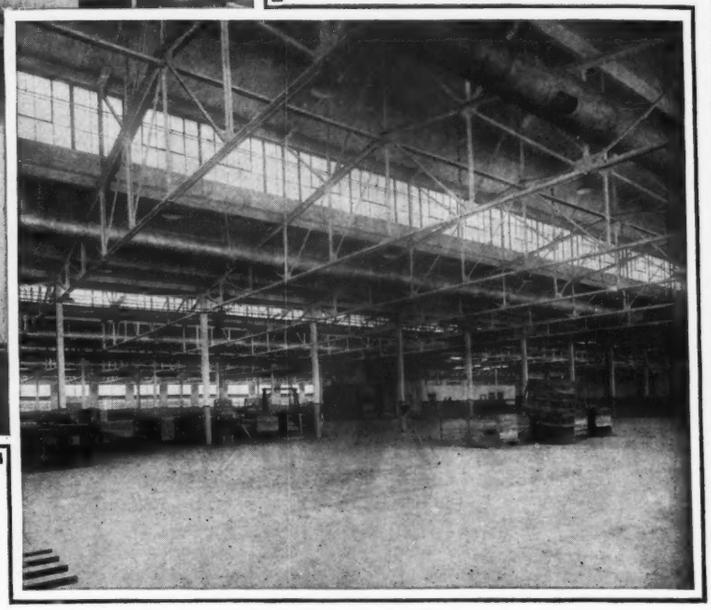

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The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

AUGUST, 1920

THE NEW MEASURE OF VENTILATION

Instructions for Using the Synthetic Air Chart Recently Adopted by the Heating Engineers' Society

BY E. VERNON HILL

President, American Society of Heating and Ventilating Engineers

THE SYNTHETIC Air Chart is designed as a means of measuring with a greater degree of accuracy than heretofore the air conditions maintained in any given room. Instead of speaking of the ventilation of a room as good, bad or indifferent, etc., the results of tests are plotted on the chart and the air conditions are recorded as a percentage of perfect. This is done by considering all of the known factors that make up the air conditions. These factors, with their proper weights, experimentally determined, are arranged in columns vertically across the chart.

The base of each column represents the ideal condition, or 100% perfect. Bordering on either side of the main columns are two narrow columns marked "+ %" and "— %," the minus per cent. denoting the penalization to be substracted from the percentage of perfect column and the plus per cent. denotes the condition considering only the one particular factor.

These various factors are divided into three groups:

First: wet-bulb difference, which includes temperature, humidity and air motion. Second: dust, bacteria and odors. Third: carbon dioxide, which is considered in relation to the air supply.

In addition, columns entitled "Other Injurious Substances" and "Distribution" are inserted. The upper limit of any of these groups represents the condition where life would cease to exist, hence at this point the "— %" column would indicate 100% penalization. (Since the upper ends of the columns represent conditions that are not found in practice they are not included in the chart.) The lower limit of any of these groups represents ideal or perfect conditions, hence at this point the "— %" column is indicated by 0.

METHOD OF GRADUATING THE COLUMNS.

To illustrate the method of graduating the columns, consider the first, which is headed "Wet-Bulb Difference." When at rest with no air motion the ideal wet-bulb temperature is 56° F. The upper portion of the column represents the unlivable condition, which is approximately 106° F. with 100% humidity. This gives a wet-bulb difference of 50°. Any variation from 56° will, therefore, represent a definite percentage of variation from the ideal, 56° being 100 % perfect or 0 in penalization, and 106° being 100% penalization and 0% perfect. The graduations in the other columns were constructed in a like manner.

RESULTS PLOTTED BY HEAVY VERTICAL LINES.

After the values of all the factors have been determined by test the results are plotted on the chart by a heavy vertical line, preferably in red ink, ⅛-in. wide, and the height of the line will indicate the results obtained in the test. Penalization for all the factors will then be read directly opposite the top of each line. All the minus percentages are then totaled and the sum subtracted from 100% to determine the percentage of perfect ventilation for the room as a whole. This result is plotted in the last column headed "Percent of Perfect."

CHART TAKES IN ALL KNOWN FACTORS.

The theory of the chart is to take all the known factors into consideration that influence air conditions and to indicate by the plotted lines how far these conditions vary from the ideal. Some may be satisfactory, while others may be so far from the ideal as to bring the total percent. below desirable. It is, therefore, easy to determine which conditions need correction. The ideal is 100% on the chart, while the unlivable is zero.

MAKING THE TEST.

Temperature, Humidity and Air Motion: Temperatures and humidities are determined with a sling psychrometer. The extent and direction of air movement in the room may be determined by observing the velocity of a puff of vapor from an ammonium chloride apparatus. This apparatus consists of a bottle of hydrochloric acid and a bottle of ammonium chloride. The small pump forces the vapors through a glass tube leading from each bottle to a common point, and when the two vapors unite a cloud of ammonium chloride is formed.

Dust: Dust determinations are made by the use of a direct counting instrument in which the air is caused to impinge against a cover slip coated with adhesive material. The particles are counted under the microscope and the result placed upon a cubic foot basis.

Bacteria: Bacterial determinations are made in accordance with the standard adopted by the American Public Health Association. Four-inch Petrie dishes containing standard

agar are exposed in the room for two minutes. They are then carefully covered and incubated for 48 hours at 22° Centigrade. The colonies on the plate are then counted.

Odors: Odors are determined in accordance with the following rating:

100%	freedom	from	odors	perfect
95%	"	"	"	very faint
90%	"	"	"	faint
85%	"	"	"	noticeable
80%	"	"	"	distinct
75%	"	"	"	decided
70%	"	"	"	strong

The determination should be made immediately upon going into the room from the outer air.

Carbon Dioxide: The apparatus necessary to take samples of air for CO_2 determinations consists of a 120 cc. rubber-stoppered bottle and a constant-pressure rubber bulb. To take a sample, the rubber tube attached to the bulb is inserted to the bottom of the bottle and held at arm's length so that the sample will not become contaminated by expired air. The tube is closed by compressing it between the thumb and neck of the bottle and the net-covered bulb is filled with air by pressing the uncovered bulb with the hand. The thumb is then released and the inrushing air replaces the original air in the bottle. This operation is repeated three times, after which the tube is removed and the bottle is tightly sealed with a rubber stopper. An analysis of the sample is then made with a Peterson-Palmquist air analysis machine and the result is given in parts of CO_2 per 10,000 parts of air.

Distribution: The distribution of the air in a room is determined from the CO_2 readings taken in the various parts of the room. The following example illustrates the method of calculating the result. Assume four samples taken resulting in the following analysis:

Station	Parts of CO_2 per 10,000
1	6.4
2	7.4
3	9.2
4	5.0
	Average 7.0

Variation from the average at various stations:

Station

$1 = 7.0 - 6.4 = 0.6$

$2 = 7.4 - 7.0 = 0.4$

$3 = 9.2 - 7.0 = 2.2$

$4 = 7.0 - 5.0 = 2.0$

Then the average variation from the average CO_2 equals:

$$\frac{0.6 + 0.4 + 2.2 + 2.0}{4} = 1.3$$

The percentage of variation equals:

$$\frac{1.3 \times 100}{7.0} = 18.6\%$$

Therefore, the percentage distribution $= 100 - 18.6 = 81.4\%$

Other Injurious Substances: This column is used in special cases only, where owing to the nature of the processes carried on some particularly injurious substance is being given to the air. The column is then graduated, consistent with the nature of the substance. For example, supposing we assume that the contaminating substance is carbon monoxide. Grubner states that symptoms of poisoning are distinct when the air contains 0.02 of 1% of this gas and that death ensues in a short time when the air contains 0.05 of 1%. Witthaus states that when a person inhales air containing carbon monoxide that the body retains about one half of the CO inhaled. The poison, therefore, accumulates in the blood and small amounts in the air may produce death if inhaled over a sufficient period of time. It is apparent, therefore, for our purpose that the lethal dose of 0.05 of 1% is too high and that 0.02 of 1%, taking into consideration the time factor, would be nearer the truth.

In arranging our scale in the column headed "Other Injurious Substances" we would, therefore, consider air free from carbon monoxide as 100% and air containing 2 parts in 10,000 as 0%, or air containing 1 part of carbon monoxide would be 50%, 1½ part 25%, etc. If a test is made of the air in a garage, for example, or other place where carbon

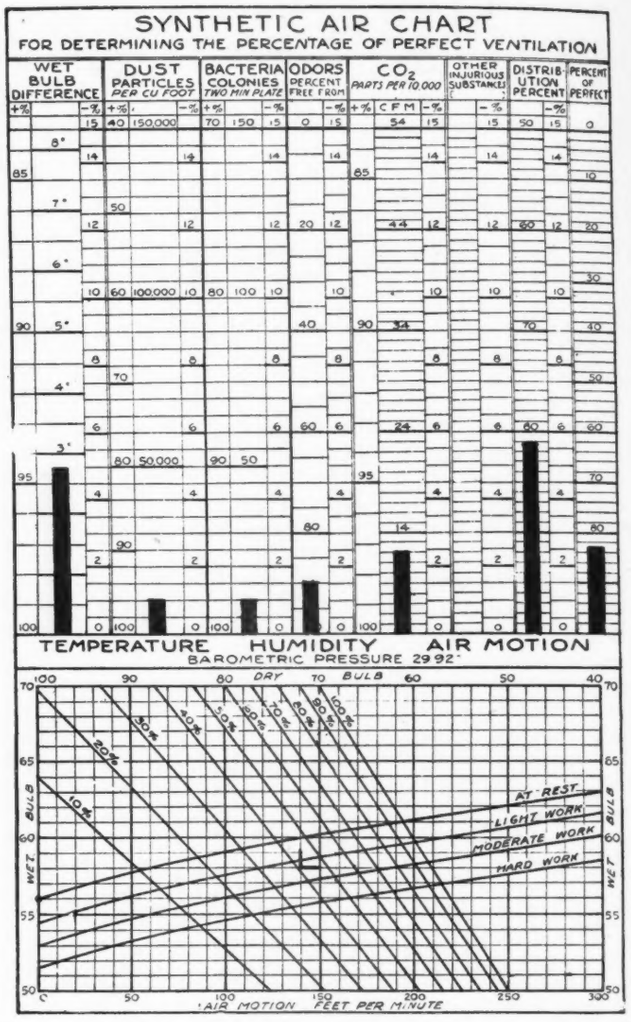


FIG. 1—TYPICAL TEST RESULTS PLOTTED ON SYNTHETIC AIR CHART

monoxide is found and the result showed 2 parts of carbon monoxide in 100,000 parts of air the penalization factor would be 10%, and this amount would be added to the other minus percentages or penalization factors and the total subtracted from 100 to obtain our final percentage of perfect.

THE COMFORT CHART.

The inter-relation of temperature, humidity and air motion is shown on the lower part of the chart. The intersection of the air motion line and the physical state line determines the proper wet-bulb temperature. This point should be indicated on the card by a small angle, thus (┐), the apex of the angle coinciding with the point of intersection of the lines. The observed dry-bulb and wet-bulb temperatures are also indicated on the card by an angle, thus, (└). The difference between the *desirable* wet-bulb and the *observed* wet-bulb is plotted in the first column of the air chart marked "Wet-Bulb Difference."

Number and Location of Stations: The number of stations where samples are to be taken should be determined from the floor area in the room. One station shall be allowed to each

200 sq. ft. of floor space. In no case should less than four samples be taken. The room should be divided equally into imaginary areas and a station located in the center of each

TEST DATA

STREET NO 210 Jones St — DATE June 30, 1920
BLDG A — ROOM 3 — FLOOR 2nd — TIME 1030 AM to 1 00 PM

STATION	TEMPERATURE DRY BULB	TEMPERATURE WET BULB	R.H.%	AIR MOTION	DUST	BACTERIA	ODORS	CO_2	SUPPLY REGISTERS AREA	SUPPLY REGISTERS VELOCITY	SUPPLY REGISTERS C.F.M.	EXHAUST REGISTERS AREA	EXHAUST REGISTERS VELOCITY	EXHAUST REGISTERS C.F.M.
1	72°	58°	41	15				6.4						
2					10,000	10	5%	7.4						
3	72°	58°	41	25				9.2						
4								8.0						
5														
6														
7														
8														
9														
AV	72°	58	41	20	10,000	10	5	7.0						

PRIMARY SENSE IMPRESSION Good — NOTES Very faint odor

NO OCCUPANTS	12	WINDOWS NO	3	RADIATORS		WEATHER Fair	
PHYSICAL STATE	Light Wk	TYPE	double hung	TYPE	SQ FT	TEMP DRY 84 WET 58 HUM 30	
AIR SPACE PER OCCUPANT	530	AREA	28	26-6-6	77	WIND DIR W VEL 9	
TOTAL AIR SUPPLY BY CO_2	300	LEAKAGE	Slight			CHICAGO COMMISSION ON VENTILATION	
AIR SUPPLY PER OCCUPANT BY CO_2 - -	25	RATIO TO CU CONTENT	1:76			TEST OF D.C.	
- - - - - FAN - -		FLOOR AREA PER PERSON	44			PLOTTED BY L.A.	
AIR DISTRIBUTION %	81.4					SUPPLIED BY E.K.H.	

FIG. 2—TEST DATA FORM ON REVERSE SIDE OF SYNTHETIC AIR CHART.

area. All determinations are to be made in the breathing zone which is from 2 ft. to 6 ft. from the floor.

RECORDING THE RESULTS.

To illustrate the method of determining the percentage of perfect ventilation, consider the results of a test as given below. The average results in a room are as follows:

Dry-bulb temperature	72° F.
Wet-bulb temperature	58° F.
Air motion	20 ft. per minute
Physical state	Light work
Dust	10,000 particles per cubic foot
Bacteria	10 colonies on a 2-min. plate
Odors	90% free from
CO_2	12 parts per 10,000
Other injurious substances	None
Distribution	81.25%

These values are now represented on the chart by a ⅛-in. vertical line drawn in the center of their respective columns. The proper wet-bulb temperature is determined by noting the point of intersection of the "light work" line and the 20-ft. air motion line. This is 55.25° F. wet bulb. Since the actual wet-bulb temperature as determined by the test is 58°, then the wet-bulb difference is 2.75°. This value is plotted in the first column and the penalization as read in the "—%" portion is —5%. For the 10,000 particles of dust, penalization is a —1%, for the bacteria, —1%, for the odors —1.5%, for the CO_2 —2.4, for the other injurious substances, —0%, and for distribution —5.7%. The sum of all these penalizations is —16.6%. Therefore, the percent of perfect ventilation in the room is 100% — 16.6% = 83.4%. This value is then plotted in the last column marked "Percent. of Perfect."

The results of this sample test are plotted on the chart shown in the illustration. In studying the chart we look first at the last column and note that the percentage of perfect as it appears on the chart is about 83. We readily see also that the factors needing correction are to be found in the first column headed "Wet-Bulb Difference" and in next to the last column headed "Distribution." It is clear, therefore, that to improve the air conditions in this room we must reduce the wet-bulb temperature by either reducing the dry-bulb or the moisture content. We should also improve the distribution by a study of the location of the supply registers, velocity through the same, or by using fans in the room to mechanically distribute the air.

The percentage of perfect in a well-ventilated class-room, for example, should be about 95. In offices, if the cubic space per occupant is ample, we should expect about 90%. In workshops and factories, where dust or other substances are liberated in the process of manufacture, we consider 85% as fairly satisfactory. A standard on a percentage basis must be sooner or later definitely established for schools, theatres, workshops, factories, etc.

AN IMPROVED FAN BLAST SYSTEM OF HEATING AND VENTILATING

II

By Albert R. Klein, C. E.

(Concluded from July Issue)

Editor's Note—*This paper intends to show the advantages gained in distribution of heat and fresh air, in reduction of heat losses and horse power and in the costs of new fan blast heating, ventilating or cooling systems if they are provided with special "circulating" air outlets. It is further shown that existing systems can be materially improved in regard to distribution of heat and air and that, in certain cases, an increase of the heating capacity can be obtained by the application of these circulating outlets.*

As THE quantity of air drawn from the interior can be made several times the quantity of the hot air supplied, it follows that a very effective circulation of air can be created in the zone that lies between the intake and the discharge openings of the outlets. This circulation is absolutely positive; if the mixture of air is introduced above the zone of occupancy the greater part, in practice one-half or more of that air, has been withdrawn from the zone of occupancy. For this reason a rapid change of air must take place in that zone. Depending upon the number and location of the outlets the circulation of air can be made more effective than in any other ventilating or heating system on account of the large quantities of air moved. For instance, in the saw-tooth building mentioned above, (see Figs. 1 and 4), in which ordinary outlets discharging directly into the zone of occupancy, were replaced by circulating outlets the circulation of air in the interior was originally calculated to take place once in every 17 minutes. When the circulating outlets were put in place they withdrew from the zone between the upper and lower openings about the same quantity of air from the interior as that of the hot air supplied and effected a circulation of air in the zone of occupancy once in every 6 minutes.

OBVIATING DRAFTS IN ZONE OF OCCUPANCY.

A special feature of the circulating outlets is that their discharging and their recirculating action takes place without causing drafts in the zone of occupancy. In hot air heating and ventilating systems hitherto installed, the common method of discharge into the interior is either to blow the air from outlets which are placed high above the zone of occupancy,

downward into the latter with velocities up to 1400 ft. per minute, or else to carry the discharge pipes to within three feet of the floor and to discharge the hot air at low velocities. With ordinary outlets there is no other way of bringing the heated or fresh air into the zone of occupancy. In both cases hot and cold drafts in the zone of occupancy are unavoidable, no matter how the outlets are arranged or what the velocities are. Moreover the full quantity of heat needed for the building is carried into the zone of occupancy creating there areas that are overheated.

With the circulating outlets these disadvantages of air heating and ventilating systems are avoided. The air is discharged horizontally above the heads of the occupant, and a large quantity of warm air is forced from the upper levels into the zone of occupancy through the circulating action of the outlets at an imperceptible velocity and in absolutely positive manner. Thus large quantities of warm or fresh air are moved through that zone without causing the least discomfort to the occupants. In the saw-tooth building mentioned above (see Figs. 1 and 4), the discharge openings were 9 ft. above the floor, the air was discharged horizontally or even slightly upwards; there was not the slightest feeling of draft in the entire room and every square foot of floor space could be occupied by the workmen and working girls without paying any attention to the warm air inlets. There was a continuous moving of machine tools and benches during the first few months after the building was occupied and all the moving was done without having been hampered by the location of the warm air inlets.

FIG. 4—TYPICAL INSTALLATION OF FAN BLAST SYSTEM WITH CIRCULATING OUTLETS.
(Reprinted from July issue.)

HIGHER TEMPERATURES OF HEATED AIR. REDUCTION IN SIZE OF BLOWER AND DUCT SYSTEM.

When heated air is discharged directly into the zone of occupancy it is not advisable to heat the air to higher temperatures than 140° F. Higher temperatures would be dangerous to the health of the occupants and, furthermore, the highly-heated air has the tendency to rise quickly to the roof or ceiling and to cause overheating there. However if, as with the circulating outlets, the heated or fresh air can be tempered with a comparatively large quantity of air taken from the interior just prior to its discharge, it is possible to give the fresh air as high or as low a temperature as an economical arrangement of the entire heating or ventilating system will allow. Thus it will be possible where steam of at least 30 lbs. pressure is available, to heat the air to 220°F.; with steam of 100 lbs. pressure or where hot waste gases can be utilized, the air may be heated to 300°F. or higher.

By using air of higher temperatures the quantities of air to be heated and transported through the system become correspondingly less and the systems are reduced in size If the air is heated to 220° F. or to 300° F. instead of to 140° F. only, the quantity of air to be heated is little more than one-half up to two-fifths of that required at 140° F.

Fig. 7 shows the quantities of heated air for various temperatures when the content of heat calculated above 60° F. is equal to that of 100000 cu. ft. of air at 140° F. In other words, if 100000 cu. ft. of air at 140° F. are needed to heat a building to 60° F. then the diagram shows that only 56700 cu. ft. are required at 220° F. and 42100 cu. ft. at 300° F. Consequently, it will be possible to reduce the sizes of air washer, blower fan and duct system to about one-half to two-fifths of what they would be with air at 140° F. Of course, it will be necessary to use a larger heater but in all cases where there is a duct system of some size the reduction in the costs of air washer, blower and duct system will amply compensate for the costs of the additional heating surface and the outlets.

It may be added that through the reduction of the quantities of the heated air there result incidental advantages in saving of space, light etc., on account of the use of smaller and fewer ducts.

LESS HORSE POWER NEEDED.

The efficiency of an outlet as shown in Figs. 1-3 acting on

the principle of an injector, is naturally low. However it must be considered that the withdrawn air and the mixed air travel only for short distances through ducts and that the velocities are low, usually between 400 and 1200 ft. per minute. In spite of the low efficiency of such an outlet it is possible in many cases to reduce the amount of horse power necessary for a ventilating or heating system by using circulating outlets and higher temperatures for the heated air.

In order to demonstrate this we will assume that a certain fan blast heating system is designed to deliver 100000 cu. ft. of air per minute at 140° F. to maintain a temperature of 60° F. in the interior and that a total resistance of 1.75 in. of water be encountered in the system. It shall then be further assumed that the temperature of the heated air be raised and that the main duct system shall be so altered as to accommodate the various quantities of heated air, leaving the total resistance of the main system at 1.75 in. We can then calculate the horse power necessary to move these various quantities of heated air, if we assume a certain efficiency of the fan. If we now suppose that circulating outlets be put in the places of the ordinary outlets, giving the discharged air the same outlet velocities as before and a temperature of 100° F. against 140° F. before, then we can calculate the total horse power necessary for the system, if we know the additional pressure caused in the system by the circulating outlets.

The results of these calculations are shown in Fig. 8. The dotted line shows the amount of horse power needed to overcome the total resistance in the main system (1.75 in.) without the circulating outlets. We can thus see for instance that if we heat the air to 220° F. and wish to discharge at 100° F. and a velocity of 1000 ft. per minute we need 43.4 horse power, whereas we need 55.0 H. P., or 27% more, if the air is heated to 140° F. only and we use ordinary outlets. If, in this same case, the air should be discharged at a velocity of 800 ft. per minute, we need only 39.0 H. P. with, against 55.0 H. P. without, circulating outlets or 41% more in the latter case than in the former.

CIRCULATING OUTLETS MUST BE OF CORRECT DESIGN.

The efficiency of the circulating outlets depends greatly upon their correct design. In the above instance the efficiency of the fan has been assumed to be 50% that of the circulating outlets 13% to 25%. It may be said that on account of the large quantities and low temperature of the air discharged through the circulating outlets the discharge velocities can be lower than with ordinary outlets to reach a given distance.

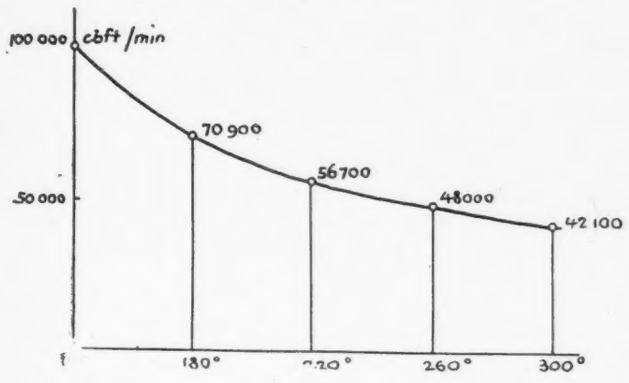


FIG. 7—QUANTITIES OF HEATED AIR NEEDED FOR VARIOUS TEMPERATURES WITH CIRCULATING OUTLETS.

APPLICATION OF CIRCULATING OUTLETS TO BUILDINGS OF MANY STORIES.

As the air can be heated to 220° F. if steam of 30 lbs. pressure is available, it is in such cases often possible to supply to a building just that quantity of air which is required for ventilating purposes only. Return ducts which would otherwise be necessary to return part of the air back to the heating apparatus and thus to save heat can be eliminated. This gives the possibility to apply the fan blast heating system to buildings with many separate rooms, such as factories, loft buildings large office buildings etc., where an elaborate system of return ducts leading back to the conditioning apparatus, would make an ordinary fan blast system impracticable.

In buildings of this type the circulating outlets would be placed along the outside walls. As the main ducts are small they can be placed against the curtain walls acting as wall radiators as shown in Fig. 2. Where there is a considerable story height an arrangement of the circulating outlets, as shown in Fig. 3, would result in a large saving of heat. The lower openings of the outlets open partly into a channel about 6 in. wide which runs above the floor along the curtain walls. The air of the interior which is cooled by contact with the walls and windows, descends into the channel and is withdrawn from there into the outlets. Thus the cold air from the walls and windows does not reach the floor at all and the walls and windows are not heated except by contact with the air of the interior. In ordinary fan blast systems it is either necessary to blow directly against the outside walls and windows or to provide direct radiation along the walls in order to prevent cold drafts near the windows and on the floor. Both ways cause considerable loss of heat and other inconveniences which are eliminated by the use of circulating outlets as shown.

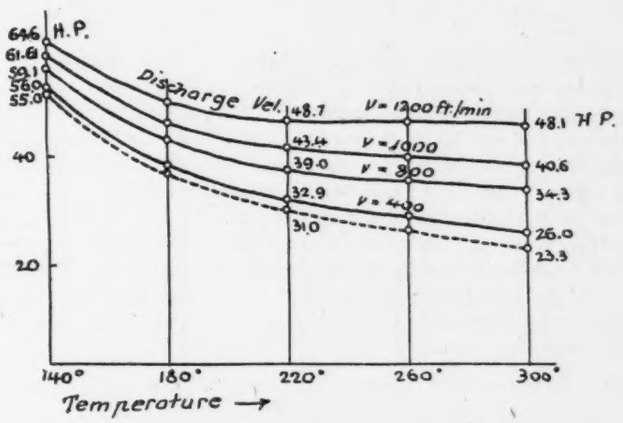


FIG. 8—CALCULATIONS SHOWING REDUCTION OF HORSE-POWER WITH CIRCULATING OUTLETS.

IMPROVEMENT OF EXISTING FAN BLAST SYSTEMS.

In many cases existing systems can, at small first costs and running expenses, be greatly improved by simply changing the ordinary outlets to circulating outlets. Depending upon the outlet velocity which is desired, a reduction in the temperature of the discharged air from 140° F. to as low as 80° F. can be obtained with only a small rise in the pressure and horse power needed in the system.

For instance, for a system delivering at present 100000 cu. ft. per minute, at 140° F., at a total resistance of 1.75 in. of water and with an outlet velocity of 1000 ft. per minute, calculated to maintain thereby a temperature of 60° F. in the interior, 55.0 H. P. are needed, as shown in Fig. 8.

If the outlets were changed to circulating outlets delivering the air at 100° F., 51.1 H. P., or an additional 4.1 H. P. would be needed. The quantity of air discharged through the outlets would thereby be doubled, the temperature reduced from 140° F. to 100° F. and the circulation of air through the zone of occupancy would be two to three times greater than before, depending upon the height of the room. In this way the distribution of heat and fresh air can be greatly improved,

heat losses can be reduced, and places which cannot be occupied on account of drafts can be made useful.

The change in the speed of the blower fan made necessary by the additional pressure from the circulating outlets, will, in most cases, not cause an appreciable change in the efficiency of the fan. As to the costs of the circulating outlets it was, for instance, found that the costs of the circulating outlets for the saw-tooth roof building mentioned earlier in this article, would be saved in two heating seasons, assuming a reduction of 5° F. in the temperature under the roof.

INCREASE OF CAPACITY OF EXISTING FAN BLAST HEATING SYSTEMS.

The reduction of the temperature of the hot air by circulating outlets often provides a means for increasing the heating capacity of an existing fan blast system and for avoiding the

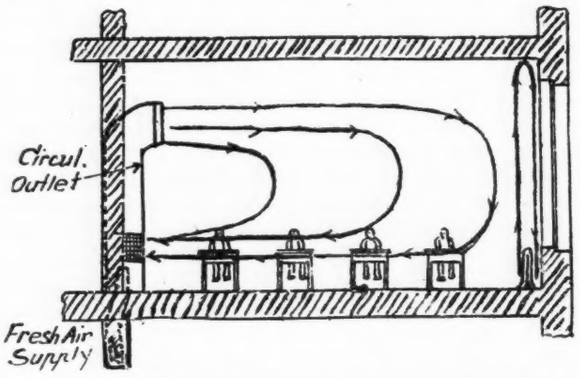


FIG. 9—USE OF CIRCULATING OUTLETS IN SCHOOLROOMS.

creation of a new heating apparatus if it is possible to increase the pressure of the steam. If, for instance, in an existing hot air system, steam of 5 lb. pressure is used in the heater and the air is delivered at 140° F. to the interior, then by raising the steam pressure to 30 lbs., the heating capacity of the system may be increased as much as 25%. The temperature of the heated air will, of course, also be raised, but through the placing of circulating outlets the temperature of the discharged air may be reduced as low as 80° F. Thus not only the disadvantages resulting from supplying too highly heated air are avoided but the system as a whole may even be considerably improved.

CIRCULATING OUTLETS FOR VENTILATION OF THEATERS, AUDIENCE HALLS, ETC.

Circulating outlets are especially useful for buildings of this type, in cases where upward ventilation is not possible or too expensive and if therefore downward ventilation has to be employed. Here the principal problem of ventilation is to introduce large volumes of fresh air at a temperature from 5 to 10 degrees lower than the temperature of the interior, without drafts and with uniform distribution reaching all parts of the zone of occupancy. By means of circulating outlets this can be accomplished because the fresh air is mixed with large quantities of air taken from the interior. The latter quantity is usually from 2 to 4 times larger than the former and as a result the temperature of the air introduced is only about 2° F. lower than that of the interior.

Furthermore, as the air quantities are so large, the air can be distributed horizontally by means of diffusers so that it covers uniformly the entire floor space. The currents of the discharged air then mix with the air in the room and are to a large part drawn through the zone of occupancy and back into the outlets. Thus a uniform and draftless ventilation of the zone of occupancy can be obtained with a minimum quantity of fresh air.

The costs of the additional power necessary for circulating outlets is, in those cases, practically negligible, as the discharge velocities in such buildings are low usually between 300 and 600 ft. per minute.

COOLING OF INTERIORS.

From the foregoing it is plain that circulating outlets can also be employed to advantage for the cooling of interiors. As the temperature of the cooled air is materially raised in the outlets through the admixture of air from the interior, the temperature difference between the discharged air and the air of the interior can be reduced to any desired extent. For this reason the fresh air can be cooled to any degree consistent with the most economical arrangement of the entire layout and the installation of an extensive system of ducts for the distribution of the cooled air, which would be necessary without the circulating outlets, is avoided.

VENTILATION OF SCHOOLHOUSES.

Quite similar to the requirements for the ventilation of such buildings as theaters, audience halls, etc., are those for the ventilation of schoolhouses. For these buildings the downward system of ventilation is almost universally in use. One of the leading ventilating engineers puts the problem of schoolhouse ventilation as follows:

"Modern school buildings offer most exacting requirements in heating and ventilation. On account of the large number of pupils seated in one room a very rapid air change is required, and this must be accomplished without drafts. The temperature must be uniform everywhere, and ventilation must be adequate. Even elaborate systems cannot secure entirely perfect distribution of air, and the only practical and successful method of insuring ample ventilation in all parts of the room is to supply air considerably in excess of the theoretical requirements. The necessity of this added capacity, or factor of safety as it may be termed, is often overlooked in writing

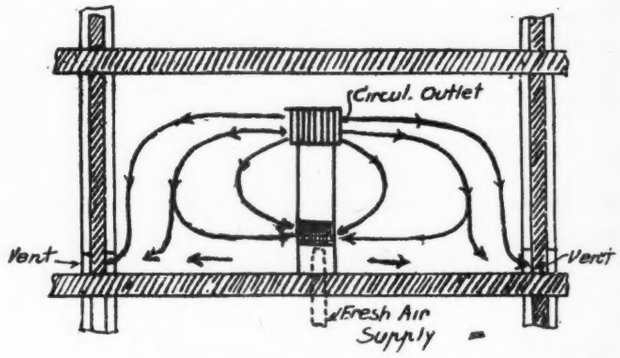


FIG. 10—ANOTHER ARRANGEMENT OF CIRCULATING OUTLETS IN SCHOOLROOMS.

specifications for school buildings. 30 cu. ft. of air per pupil, which is usually specified, will allow from six to seven parts CO_2 in 10,000. Individually this is ample, but collectively insufficient, since to insure that this per cent. of CO_2 is nowhere exceeded, it would probably be necessary to supply an average of nearly 40 cu. ft. per pupil."

It will be seen that the circulating outlets are entirely fitted for use in the ventilation of schoolrooms. The fresh air is mixed with air from the interior, the temperature of the air discharged is almost the same as that of the air in the room, the air quantities are large and can be discharged by means of diffusers without drafts over the entire room, and the air is forced to travel at an imperceptible velocity through the zone of occupancy in its return to the lower ends of the outlets and to the vent openings (see Figs. 9 and 10). If a change of air has taken place in the zone of occupancy every ten minutes without circulating outlets, it will take place every three minutes if the quantity of the air withdrawn is only twice of that of the fresh air supplied.

With the use of circulating outlets the temperature and the purity of the air must be practically uniform in the interior. With a change of air every three minutes in the zone of

occupancy, the possibility of the formation of individual zones of discomfort resulting from the discharge of the bodily heat of the occupants, is greatly reduced, if not altogether avoided —a condition eagerly sought for in modern ventilation.

ELIMINATION OF NOISES IN HEATING AND VENTILATING SYSTEMS

Notes on the Cause, Effect and Prevention of Mechanical, Air and Water Hammer Vibrations

IV

(*Continued from July issue.*)

SELECTION OF FAN AND MOTOR SPEEDS AND METHOD OF CONNECTING APPARATUS MECHANICALLY FOR QUIET OPERATION.

The maximum peripheral velocity of fan wheels should not exceed 3600 lin. ft. per minute, in particular if located in an attic. Objectional conditions may arise when the air passageway between a fan and the first duct outlet is short, say 50 ft. or less, so that it may be necessary to limit the peripheral velocity still more; whereas under converse conditions, a velocity of 4000 ft. per minute may be permitted. Furthermore, the air velocity through the fan-discharge outlet should not exceed 1800 lin. ft. per minute, and the variation from this rate across the duct cross-section should not be more than 20%. Vibration of fan blades due to cutting the air may be reduced by curving the ends slightly backward, but this decreases the fan efficiency slightly. This modification is permissible, however, when the distance between the fan and the nearest duct is less than 50 ft.

Fan wheels should be perfectly balanced before shipment to minimize vibrations, while the casings should be reinforced and stiffened. The shaft should be provided with self-oiling babbitted bearings of the loose-ring type and should be self-aligning in all directions, since any uneveness will cause knocks which will be transmitted through the air passages.

REASONS FOR USING SPEED REDUCING TRANSMISSIONS.

Unless motors with an unusually large number of poles are used, a construction which makes them relatively expensive, alternating-current motors will not operate at speeds as low as the economical speed of fans. For this reason speed reducing transmissions, such as belts, silent-chain drive and the like, are usually required; the latter especially where the distance between the motor and the fan is small. Silent-chain drives are not advisable, however, when they must be installed in passageways through which the air is forced, especially if the discharge path to the nearest register is less than 100 ft. a soft flexible belt with cemented joints should be used and tightened so as to prevent flapping, single or double-ply belts being used for large units, as they are more pliable and quieter than double ply.

In purchasing or specifying electric motors, the requirements should be made that the motors be tested at the factory for noise and guaranteed for quietness of operation. Only where the fan and motor are set remote from the nearest opening should speeds above 900 R. P. M. be permitted, in particular if the fan is set in an attic space, over occupied rooms, or in a pent house on the roof; since with the higher speeds there is considerable more noise. Low-speed motors are, therefore, much more desirable.

Direct-connected motors eliminate the noise and up-keep of speed-reducing transmissions, and are sometimes imperative where only limited space is available, but owing to the low speed the motors required, are relatively expensive. While the operation of steam engine-driven fans permits direct connection of units and the utilization of exhaust steam in the air heating coils or in a heating system, it involves the use of a boiler which must be capable of operating occasionally at higher than the average pressure; also reducing valves, low and high-pressure piping, boiler-feed pumps, grease extractors, steam separators etc., and in many cities the supervision of a licensed engineer. On the other hand, the initial investment and operating and maintenance expenses are considerably lower with motor-driven fans, especially where energy can be purchased at a fairly low rate. When an electric generating plant is employed where the fan equipment is required or where the fan must be placed in an attic or penthouse, it is always preferable to use motor drive. A horizontal engine will be quieter in action than a vertical one, though either of these, as usually made for driving fans, will be productive of more noise than those used in power-plant work. Flexible couplings are often used in direct-connected fan units since these adjust themselves to any slight inequalities of alignment.

NOISES FROM AIR VIBRATION.

In public building work, such as schools, hospitals, etc., the following air velocities in the ducts are desirable, the minimum velocity stated being preferable in order to eliminate the noise of air travel at the register.

1000 ft. per minute to 1200 ft. in the main duct from the fan to the point of the first branch connection, or possibly further.

600 to 800 ft. velocity in major branches and in the continuation of the main duct.

400 to 600 ft. velocity in short and small branches and in the extreme ends of the main ducts, or near registers.

In industrial work, these velocities may be made 50% or even 100% greater. In refuse exhaust steam systems, still higher velocities are used. Abrupt changes of direction should be avoided in the ducts, making turns by easy bends and supporting the ducts at proper points to eliminate vibration. The noise from a vent fan discharging at a high velocity into a shaft of limited size may also be eliminated by handling an equal volume of air with a larger fan at a decrease in velocity.

VIBRATION OF PIPING DUE TO PULSATING STEAM FLOW.

In the first part of this article it was recommended that a separator of large size be installed as close to the engine as possible, the main purpose being to remove water from

the steam. This, however, is not the only advantage to be obtained, since vibrations of the steam piping are also prevented by passing the steam through a separator or receiver, providing this is made with suitable capacity. The latter acts as a cushion to absorb the shocks due to valves of the engine constantly opening and closing, thus causing pulsations of the steam in the pipes. These vibrations from the sudden cut-off in the steam chest of the engine, cause pipes to leave their supports or the supports to loosen and part from walls or beams.

Vibrations in pipe lines are also caused by the steam flowing with an occasional abrupt change of direction due to short turn tees or elbows, or by vibration of the velocity of this flow throughout the system.

Under certain conditions high-pressure boilers will vibrate. If they are not provided with sufficient steam space, the boilers when working at overload will cause a rapid lowering of pressure and this in turn causes violent ebullition with a vibrating result. Such vibrations will be transmitted to the connected piping. Similarly, improperly-adjusted governors or valve mechanisms of engines may cause engines to vibrate and where more than one high-speed engine is running, there is apt to be synchronism or vibration in unison, which will set all pipes to vibrating.

Pipes should be arranged to a certain extent for flexibility so as to allow for expansion and contraction. At the same time they should be designed with a view to eliminating the cause of these vibrations by the use of long-turn bends, suitably designed and properly spaced anchors and supports, and receivers of proper size and location, as previously recommended. Finally, the piping system, so far as practical, should be proportioned throughout for a uniform velocity of the stream flow. Pipe fractures longitudinally near the middle of its length when tested to destruction, but under expansion and contraction strains, most of the fractures that occur are circumferential; either in the pipe near flanges or in the flanges themselves. Therefore, anchors and supports should preferably be located at flanges or joints and at the connection to apparatus in order to relieve the stresses at such points. The number of these depends upon the length of pipe, but in runs less than 50 ft. usually one anchor at the middle is sufficient, the pipe in this case expending on both sides away from the anchor. Expansion loops should be installed in a horizontal plane to avoid pockets and, where possible, bends should be used in place of fitting, whenever change of direction occurs.

Pipe and fittings with defective threads should not be used in a piping system, nor should unnecessary force be used in their erection, otherwise a strain is placed on the piping which becomes intensified when the pipe is heated.

Vibrations are often set up in exhaust pipes, due to mechanical vibrations or to air vibrations from the intermittent discharge of the exhaust directly outboard. If the piping is of large size and with but few bends, no difficulties may be experienced, but with several engines exhausting in the same line, vibrations are more pronounced. Sometimes it is more advisable to run separate exhaust lines to the condenser, in particular if the units are near one another and vary considerable in the amount of exhaust. An engine of large size should not discharge into the same main at the same time as one of such smaller size. The exhaust main should be of ample size, more in the nature of a header, at least near the points where connections are made and these branches should connect with the main by means of wye fittings.

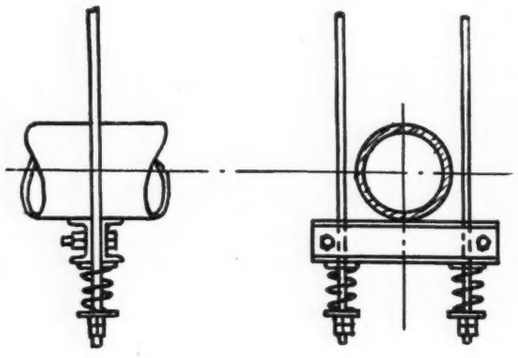


FIG. 30.

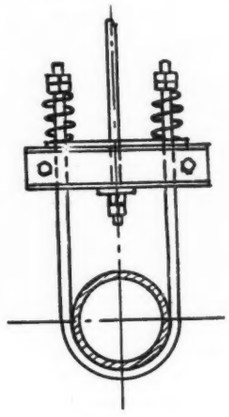


FIG. 31.

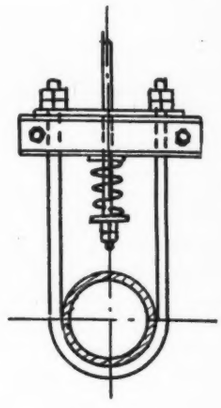


FIG. 32.

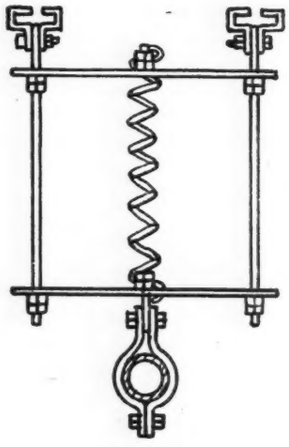


FIG. 33.

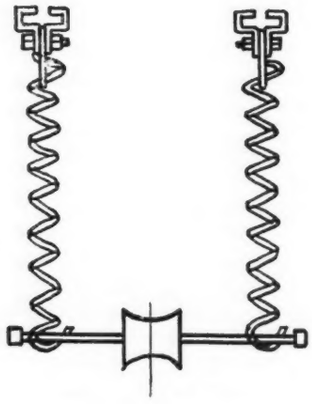


FIG. 34.

FIG. 35.

VARIOUS TYPES OF SPRING HANGERS TO ELIMINATE VIBRATION OF PIPING.

SPRING HANGERS TO OFFSET VIBRATIONS OF PIPING.

In Figs. 30 to 35 inc., various forms of spring hangers are shown. These have been designed to eliminate swaying of pipe lines due to vibrations of building or machinery. In Fig. 30, two rods are carried through between channels placed back to back and have springs located between the channels and nuts on the bottom of the rod. If there is room above the pipe sufficient to allow the use of the hanger, shown in Fig. 31, it will be just as satisfactory and is cheaper than using two rods. In this design, it is well to use a separator

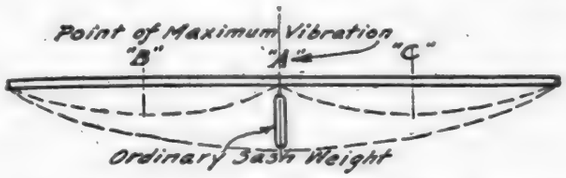


FIG. 36—DISTRIBUTING VIBRATIONS MORE UNIFORMLY OVER A PIPE BY MEANS OF A WEIGHT SUSPENDED AT THE POINT OF MAXIMUM VIBRATIONS.

plate on the top of the channel to keep the middle rod in proper position, this plate having three holes, two being for the U-bolt and one being for the hanger rod. A still cheaper form of hanger, requiring only one spring, is shown in Fig. 32, but it must be remembered that a single spring will have to carry twice the load supported on the other two.

There is still another method of overcoming vibrations of piping, providing the point of maximum vibration is found. As shown in Fig. 36, this is usually near the center of the pipe run at this point an ordinary sash weight, may be hung to offset or reduce the vibrations to a point more desirable. The stresses are then distributed more uniformly over the pipe run, the former point A of maximum vibration being divided into two points, B and C, each of lesser vibration.

AIR AND VACUUM CHAMBERS ON PUMPS TO AVOID SHOCK OR WATER HAMMER.

Suitably proportioned air chambers are recommended on all piston pumps to absorb the shock of the discharge and obtain a continuous flow of water in the discharge pipe, with as nearly a uniform velocity as possible; otherwise the pumps are liable to pound badly and wear out their various working parts. This knocking is caused by the flow of water in the suction and discharge pipes being interrupted and coming to rest at the end of each stroke when the piston changes its direction of motion. If the pipes are very long, the force required to stop and start this column of water will cause such severe shocks that power will be absorbed and severe stresses set up in the pump and piping. Water is almost non-compressible, but air is capable of being compressed to act as an air cushion and thus use up the force of the column of water striking it within the chamber. During the suction, the compressed air will expand and accelerate the moving column of water, diminishing with the expansion of the air. In this way, these chambers serve the same purpose that flywheel does in the case of a steam engine.

DESIGN AND OPERATION OF REVERSING DAMPERS FOR THEATRE VENTILATION

REVERSING dampers and their function in connection with the ventilation system, are by now more or less familiar to most of us, though just how these are built is seldom stated, except in so far as the specifications give a general outline of their construction. It is important, however, that such dampers form air-tight joints at all points of contact with the casing and still be flexible enough to enable the dampers to be easily operated. Furthermore, they should be securely pivoted at the center and should be balanced very carefully. The accompanying working, assembly and location drawings show how these requirements were met in a recent installation with dampers of rather unique and substantial design.

For the benefit of those who are not familiar with reversing dampers and their application, it may be stated that they are located in the main supply and exhaust ducts and are more generally used in connection with heating and ventilation of theatres, in particular where an air cooling system is installed for summer use.

The problem of air diffusion becomes more serious in larger rooms, and especially in auditoriums, the best results usually being obtained by exhausting the air through the floor by means of mushroom openings and supplying the air through openings in the ceilings. The reason for exhausting the air through the floor, rather than the supply of air through the floor, is that in order to prevent excess to 15° less than room temperature and air at such a low temperature cannot be admitted in the immediate vicinity of the occupants without producing a serious chilling effect. When the outside air is of a higher temperature, as in warm weather, and the immediate relief of heat is necessary, it is desirable to reverse the direction of the air current so that the air may come up through the floor and after passing over the body, go out at the ceiling. Such a reversal of the ventilation system may be easily obtained by the use of reversing dampers, as shown in the drawings. Practically no complications are involved in this scheme and by its use all the advantages of the upward and downward system of ventilation may be had at will.

DETAILS OF ARRANGEMENT.

By reference to the basement location plan with its sections and elevations, it will be seen that the air for the theatre is preheated and washed and then discharged from the fresh-air fan so as to pass through the re-heater, or by-pass underneath, as controlled by means of a damper. From the reheater and by-pass, air enters at one side of the reversing dampers and passes to the mixing dampers and ducts of the system.

There are two reversing dampers, set one above the other, in the center of a large double distributing chamber, the upper section and damper being for reheated or hot air and the lower for cold or pre-heated air. This central division of the casing extends horizontally from the by-pass under the reheater through the distributing chamber up to the two sets of mixing dampers located in the supply and and exhaust air ducts. Large doors are provided for access to the interior of the upper and lower sections of the distributing chamber.

In the normal position, which is that shown on the plan, heated air is furnished to the roof of the auditorium and to the upper part of the stage and lower part of the gallery, the exhaust ducts being near the floor arranged on the outside walls. When the position of the dampers is reversed or revolved 90° around the building column, the air is directed as shown by dotted arrows, fresh air being furnished low down near the floor and the exhaust air taken off at the ceiling and above the stage, etc. With the dampers in either

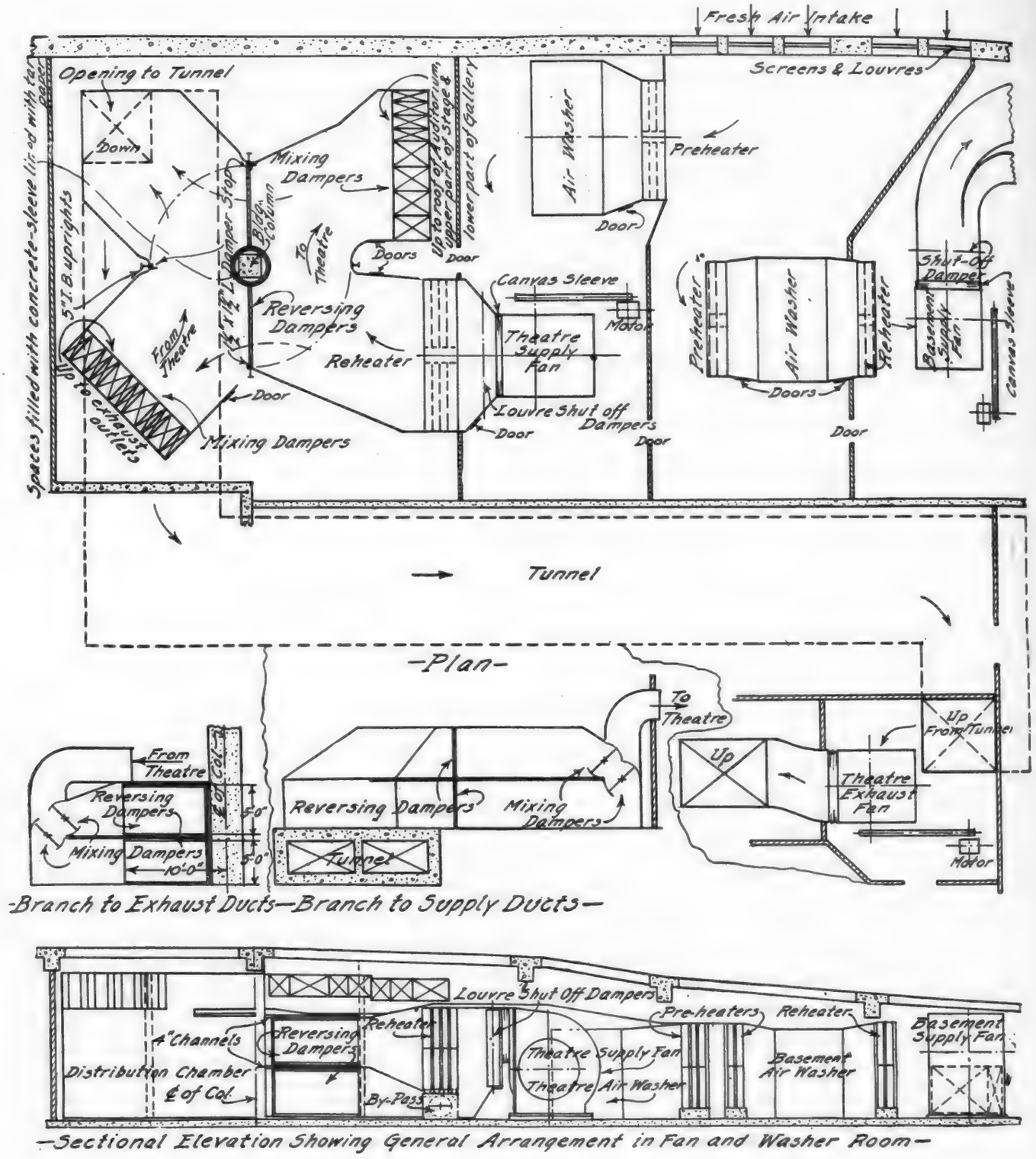


FIG. 1—GENERAL ARRANGEMENT OF VENTILATING SYSTEM WITH REVERSING DAMPERS, IN THEATRE BUILDING.

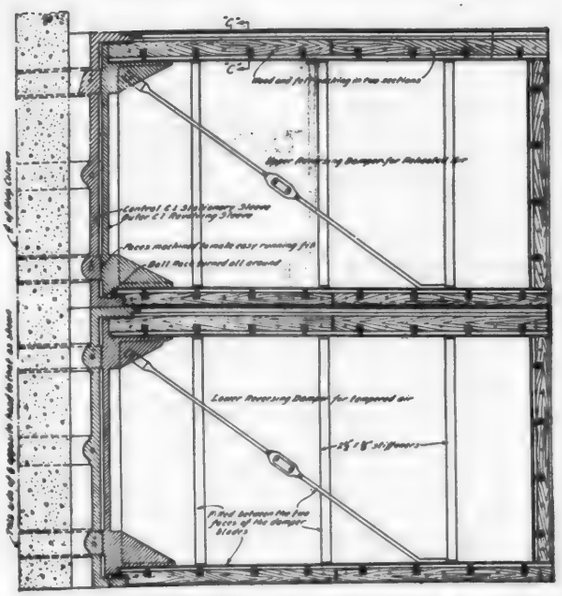


FIG. 2—CONSTRUCTION OF REVERSING DAMPERS.

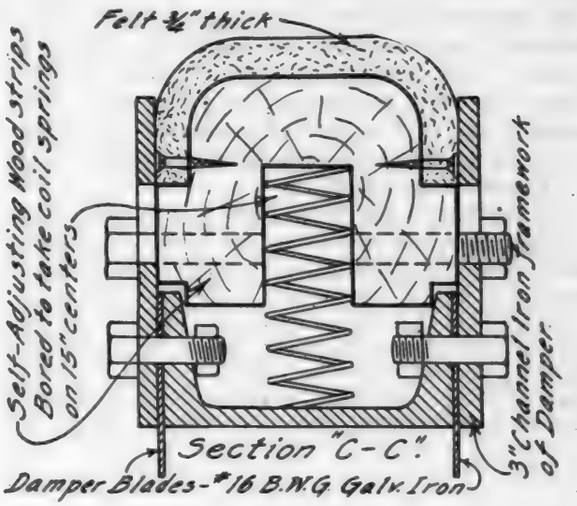

Felt ½" thick
Self-Adjusting Wood strips Bored to take coil springs on 15" centers
3"Channel Iron framework of Damper
Section "C-C"
Damper Blades-#16 B.W.G. Galv. Iron

FIG. 3—SECTION ON LINE C-C OF FIG. 2.

position, the air enters from the supply fan to one side of these dampers and, after passing through ducts to the theatre, is exhausted through the opposite system of ducts and returns to the other side of the reversing dampers, passing thence through a tunnel to the exhaust fan.

The upper and lower reversing dampers have each a central cast-iron stationary sleeve split vertically. The two halves thus formed are assembled around the building column and the spaces left between the column and sleeve filled with concrete. Each sleeve is also lined with tar paper and bolted together by six 7/8-in. bolts Outside of this sleeve is fitted concentrically a second cast-iron revolving sleeve, also split vertically, the two halves being fastened together by fourteen ¾-in. bolts. Each of these sleeves have bearing strips which are machined so that the outer sleeve will make a good running fit around the inner sleeve and revolve freely with the full load of the damper applied, without the ends of the same being supported. The bottom of each inner sleeve serves as a support for its respective outer sleeve and is fitted with ball bearings to insure easy operation.

The ball races are accessible without any special provision for oiling. All the operator has to do is to take a squirt can and fill the ball race with oil. The rubbing surfaces of the inner sleeve are oiled through oiling holes drilled through the outer sleeve on which oil cups can be applied if necessary, but it does not appear to be essential to have these cups installed as there is ample room between the sleeves, the clearance being 1/32 in. or 1/64 in, on each side.

DAMPERS OPERATED BY HAND.

The dampers weigh six tons and are operated by hand because of the high cost of mechanical or automatic operation. It would have taken a number of diaphragm or piston-

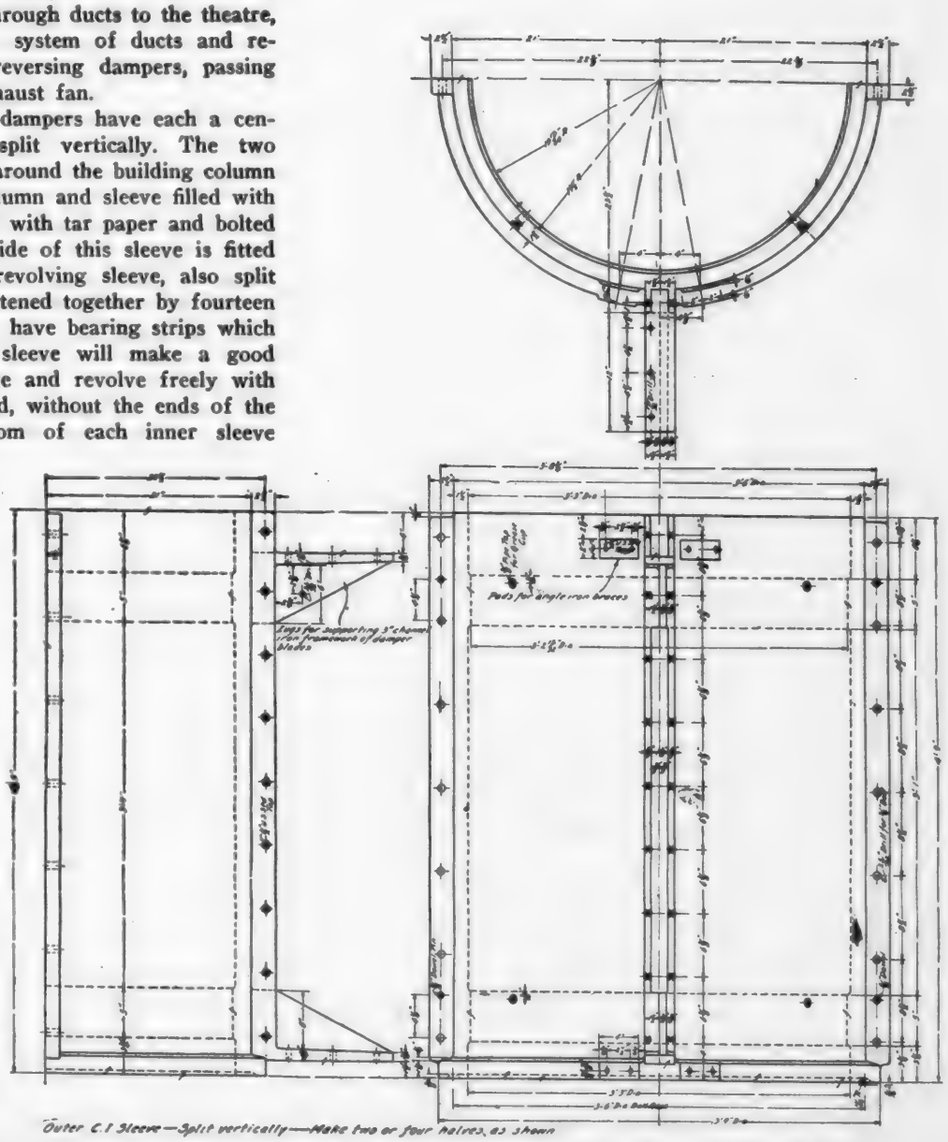


FIG. 4—CONSTRUCTION OF OUTER CAST-IRON REVOLVING SLEEVE OF REVERSING DAMPER.

type motors to turn them around, or of course, they might have been turned around by a motor. However, since the reversing of these dampers is required only once or twice a year, it is not necessary to go to the expense of installing special reversing mechanism. The chamber in which the dampers are set is so large that an operator can go inside and push the dampers around and then lock them in position by a simple locking device.

The castings, after being rough-turned and machined as required, were allowed to set for three weeks before the final turning and machinery operations were done. Eight pads were cast on the outside of the outer sleeves to which are bolted the eight 1½-in. by 1½-in. angle-iron braces. Four lugs are provided on the upper end of each inner sleeve for receiving the bolts that hold the ends of the 4-in. channel framing which supports the central diaphragm and upper plates of the chamber casing. The other ends of the 4-in.

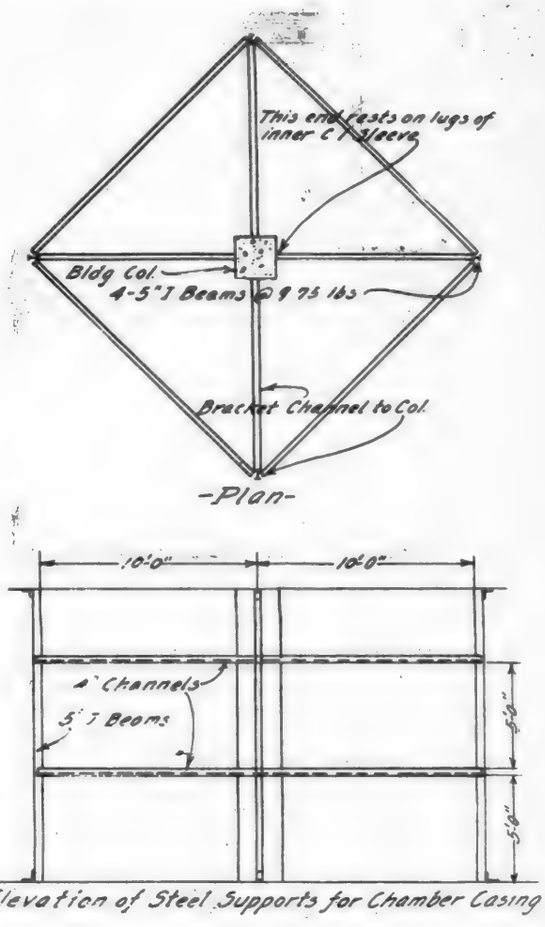


FIG. 6—PLAN AND ELEVATION OF STEEL SUPPORTS FOR CHAMBER CASING.

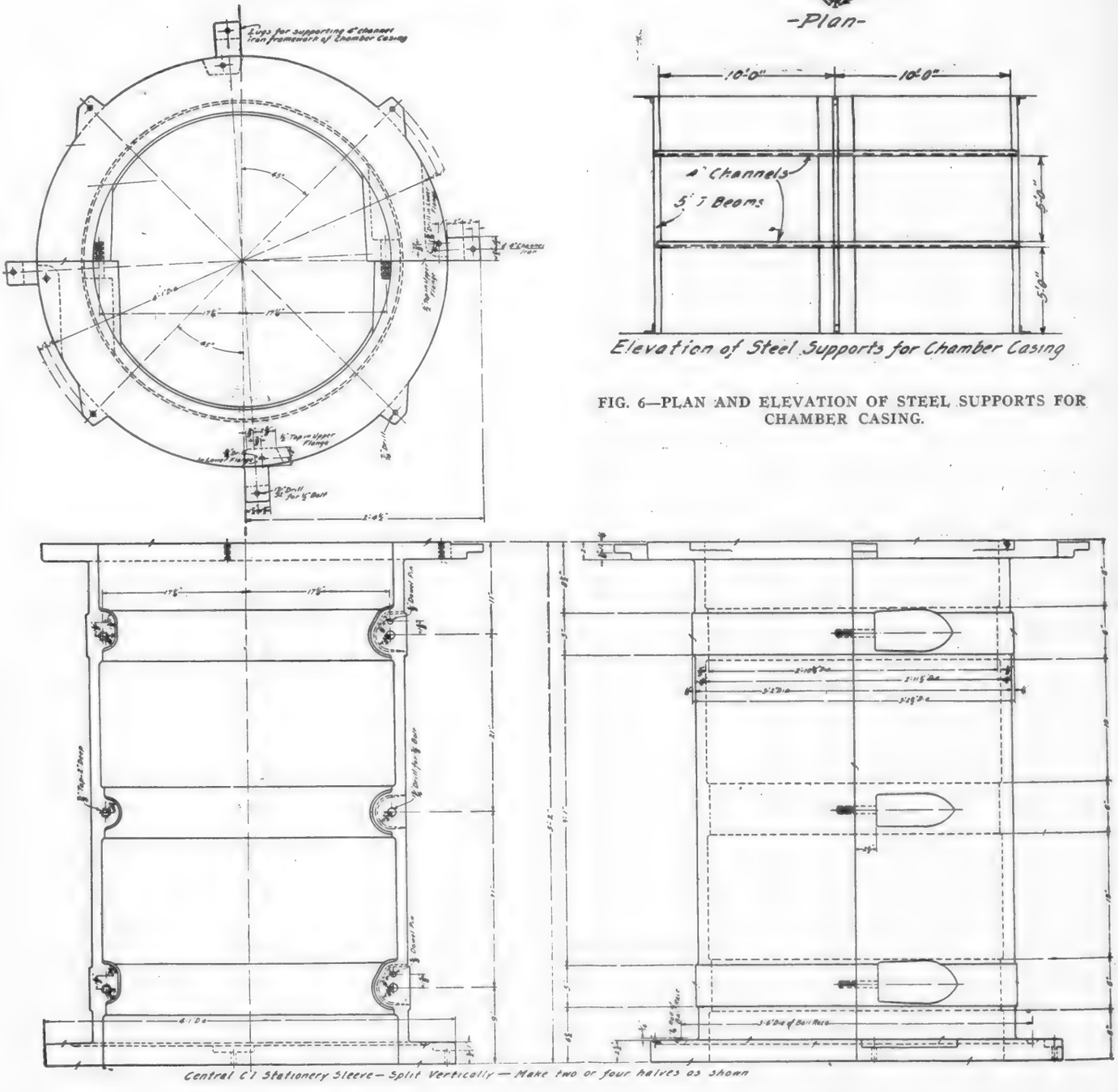


FIG. 5—CONSTRUCTION OF CENTRAL, CAST-IRON STATIONARY SLEEVE OF REVERSING DAMPER.

channels are supported by 5-in. I-beam uprights, as shown in the "Elevation of Steel Supports for Chamber Casing."

CONSTRUCTION OF DAMPER BLADES.

The damper blades are constructed as shown on the drawings and bolted to the lugs on the outer cast-iron sleeves. The framing of the blades consists of 3-in. channels set 3-in. from each edge of the damper blades, except where these are bolted to the sleeves.

The side plates of the blades are stiffened by flat strips 2½ in. wide by ¼ in. thick. To prevent sagging at the ends, each blade is supported by a diagonal brace bolted at the lower end to the 3-in. channels and at the upper end to the lug on the outer sleeve. The diagonal brace has a flat-foot at the lower end and a fork at the upper end. The channel framing, stiffening strips and diagonal supports are all fitted between the two faces of the damper blades.

In order that the strain due to turning the dampers will not injure the blades at the point where they are bolted to the cast-iron sleeve, each blade is braced by four 1½-in. by 1½-in. angle-irons bolted to the outer cast-iron sleeve and to the 3-in. channels, as shown on the drawing.

The damper plates are of No. 16 B. W. G. galvanized sheet-iron or steel plate, bolted to the steel framing and angle-iron. Black steel plate or electric spot welding would no doubt be equally as suitable for this purpose.

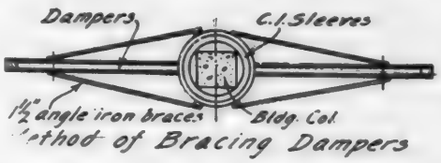


FIG. 7—METHOD OF BRACING DAMPERS.

In order to make a tight joint between the dampers and the air-chamber casing, each damper blade is fitted on three edges with self-adjusting wood strips covered with felt ¼ in. thick. The adjustment of the wood is maintained by springs set between the 3-in. channel frame of the damper blade and the wood strip. The latter is bored to take the springs which are of the coil type and set 15 in. apart. The wood strips on the long edges of the blades are in two lengths.

CENTRAL HEATING RULES AND REGULATIONS

Importance of Their Enforcement with Special Reference to Sufficient Radiation, Proper Piping, Adequate Insulation and use of Cooling Coils

BY F. A. TUCKER

Heating Engineer, Danville (Ill.) Street Railway and Lighting Company

A GREAT deal has been said by central heating engineers of late years on the subject of co-operating with the consumer, and the advantages of co-operation are, in general, very well understood at the present time. One might infer, perhaps, from some discussions on the subject, that co-operation being desirable, should always be offered by the company but might be left to the consumer to accept or reject as he saw fit. As a matter of fact most central heating companies have come to recognize that this is not going far enough, but that to a certain degree, at least, the consumer must be compelled to accept and act on the expert advice which the heating company is in a position to furnish.

It might seem peculiar that it would be necessary to force co-operation on the consumer and, of course, it is not so in every case. Very many consumers are reluctant to accept it and this for a number of reasons which the company does well to realize. In the first place, the generation and utilization of heat is a process with which the consumer of average size in times past has had more or less intimate experience. He may have fired a boiler or furnace himself and had occasion to observe the various phenomena of heating. As a result of such personal experience, he has gained the idea that he himself is a pretty good judge of what he needs, and naturally resents anything which may tend to upset his personal convictions. Whenever this average consumer has gotten into difficulties he has formed the habit of calling in his favorite heating contractor, and has come to rely on him as the last word on the subject of heating. Now whatever may have been the status of the contractor as a heating engineer, as a business man he has had to give his customer in the long run what the customer insisted on having, particularly in the matter of price. Many times this has not meant what was best for the customer. Along comes the heating company, usually a corporation of fair size, often a monopoly, with certain ideas which may conflict with those of the consumer or the heating contractor particularly in the matter of cost. It is not surprising that the efforts of the company appear sometimes in a vastly different light from that of co-operation.

IMPORTANCE OF ENFORCING RULES AND REGULATIONS.

Forcible co-operation consists simply of the enforcement of certain rules and regulations regarding the installation of heating systems on customers' premises. The principle reason for their enforcement is to secure a certain standard of service both as to quality and economy. The standard does not always represent the maximum of service obtainable but usually only the amount which the company can reasonably be expected to insist upon to protect itself and the good will of its consumers. These things which the company can reasonably be expected to require are generally accepted as given below.

NECESSARY REQUIREMENTS.

1. There must be sufficient radiation in the building to heat it to the temperature desired by the consumer on the coldest day experienced. It is often found that the consumer objects to paying for as much radiation as so calculated, his reason usually being that he is willing to put up with a lower temperature on a cold day and save the first cost. It may well be, however, that the building in the future will be occupied by a consumer other than the one making the original installation, and that this second consumer is not willing to submit to sub-normal temperatures. The first party to be blamed in such a case is the company, and it is not always possible and never

easy to convince a consumer that his building is short on radiation. It is a wise policy to insist on the full required amount of radiation to maintain a standard normal inside temperature, except possibly in certain special cases.

2. The method of figuring the required radiation should be specified. Most heating engineers are aware of the widely different results obtained by various rules for figuring radiation in common use. Present-day tendencies are toward the abandonment of the various rule-of-thumb methods and the adoption of some "B. T. U." rule.

3. The piping within the building must be of sufficient size and properly installed to supply all the radiation with steam at a certain minimum initial pressure, usually taken at 1 lb. gauge. To make the rule of maximum service it is well to specify a schedule of pipe sizes for the more common types of heating systems. A much more difficult phase of this part of the rules is to secure proper installation of the piping. An article recently appeared in this magazine illustrating some of the vagaries of the steam fitters art. These illustrations could be multiplied many times. They indicate that a careful system of inspection is necessary in order to make the rules effective.

4. Some means must be adopted to extract at least part of the heat from the condensation before discharging the condensation to the meter. This rule is necessary and reasonable on two counts. On the customer's side it results in increased economy, due to the use of heat otherwise wasted. On the company's side it lessens the investment in steam generating and distributing equipment (of which the customer gets the benefit in lower rates); and also materially improves the quality of service at times of high heat demands.

VARIOUS METHODS OF COOLING CONDENSATION.

There are three standard methods in use for cooling condensation. The first is by the use of the well-known "economy coil." The second is by using direct radiation, as in the Atmospheric system. The third is by using the condensation to warm water which may be used in the building for domestic or sanitary purposes. The "economy coil" has been much used in the past, and, if properly installed, is fairly efficient. However, compared with the other two methods it is difficult to secure an installation satisfactory from the structural reasonable first cost and efficiency standpoints. The heat in the condensation can be transferred to domestic water by running the condensation through a suitable coil immersed in the water. This method can be made much more efficient than the first, and requires relatively little in the way of special fittings or appliances. It deserves more consideration than it appears to have had in the past. The use of direct radiation for cooling condensation is convenient and highly efficient. It is probably the best of the three methods described, but of course requires a special type of heating system.

5. Bare piping passing through space where heat is not desired should be covered with suitable insulation. In this case the argument will usually be advanced that if the consumer is willing to pay for the steam used in such pipes, he should not be required to cover them. The argument lacks force for two reasons. First, steam condensed unnecessarily, even though paid for, is direct waste and as such hinders good service to other consumers. Second, the customer rarely appreciates the magnitude of the loss and often is a chronic "kicker" about his bills; bills which could be materially reduced by eliminating unnecessary condensation. It is better to settle the question to start with by insisting on suitable covering.

6. Proper provision must be made for the installation of the condensation meter. By this is meant, first, that a suitable meter outlet to the sewer must be furnished; second, that the meter must be easily accessible; and third, that no rubbish or dirt is allowed to accumulate on or around it.

SPECIAL PROVISIONS FOR LOCAL CONDITIONS.

There are many special provisions covering local conditions and details of the apparatus. Most companies specify the type and size of steam trap to be used. In some cases new heating systems must be of a particular type. The quality of the pipe covering is usually specified. In one case it was found necessary to require that if a consumer on an upper floor of a building desired an individual meter he must arrange to have all his mains on his own floor. No one should be allowed to connect to the company's service pipes or install services except the company itself.

HEATING CONTRACTORS SHOULD BE KEPT INFORMED OF COMPANY'S RULES.

The actual work of enforcing the rules can perhaps best be taken care of by first keeping all heating contractors informed as to exactly what the rules are including prompt notification of changes therein. A second requirement usually found necessary is that the details of all the interior work on customer's premises must be submitted to the heating company and approved by it before commencement of the actual work. After the details are approved and the job completed, inspection of the job itself is necessary. Very often small mistakes will be uncovered by this final inspection, the correction of which in the beginning will save much hard feeling later on.

It can be seen that the enforcement of rules and regulations is not a routine or rule-of-thumb affair. As a matter of fact there are few better channels through which the company may work to build up and strengthen the good-will of its customers. It must constantly be borne in mind that rule enforcement is only a form of co-operation. The rules usually represent the minimum requirements for good service and their simple enforcement represents the minimum of co-operation on the company's part. There is a large field for further co-operation whereby the customer can be induced to design his installation so as to secure the maximum service and consequently the maximum good feeling between himself and the company.

PROPER PERSON REQUIRED TO ENFORCE RULES.

The adoption of a set of rules by the company is the first step in forcible co-operation. The next step is the delegation to a proper person of the duty of enforcing the rules. Most heating companies are coming to realize that this cannot be handled competently by a man who has many other duties outside of the heating department. This work, along with the other details of the operation of the heating department, to be done well, must be done by a man whose first and foremost obligation is to the heating department. The introduction of rule enforcement in a company previously without it is attended with a good deal of difficulty for reasons mentioned before. The person in charge of the work must have tact and patience. He must sooner or later convince the heating contractors and consumers that he is competent, fair and reasonable. He must be competent for his suggestions to carry weight. He must be fair and without discrimination between contractors and between consumers. He must be reasonable in trying to secure the highest type of service at what, in any particular instance may be a reasonable investment in heating system. He must be firm in the prevention of all wilful attempts to evade the rules.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

ADDITIONAL ABSTRACTS OF PAPERS PRESENTED AT RECENT SEMI-ANNUAL MEETING

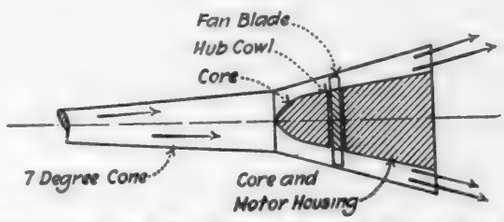
High Efficiency Air Flow.

The unusual opportunities presented in aeronautical work for the study of the behavior of air in motion have led to an interesting series of tests at McCook Field, Dayton, O., in which use was made of a specially-constructed wind tunnel. Many of the phenomena observed, it was found, have a direct bearing on the work of the ventilating engineer. The most novel feature of the tests was the development of means for visualizing air flow. This is accomplished by lowering the temperature of the air through expansion of the air due to 100 in. of water suction at the throat of the wind tunnel. This results in condensing the moisture out of the air as a visible fog. Motion pictures were then taken with the aid of several carbon arc search lights of the air flow under various conditions and some surprising results observed.

The wind tunnel itself is equipped with a 200 H. P. fan which gives an air current of 500 miles per hour 14 in. in diameter. The general shape is that of a venturi tube 19 ft. long. The air enters by a carefully-designed intake bell, reaches maximum velocity at the throat where it impinges against the aeronautical model under test, and decelerates in the expansion cone, being exhausted into the room by a 5 ft. 24-in. propeller fan. The unusual efficiency of 76% has been obtained by departing from conventional practice.

The motion pictures taken yielded much information on the matter of vortices in the air flow which, it was found, were structurally similar to meteorological cyclones and absorb a surprising amount of energy. The tests also made it possible to study the rotary motion of air streams.

One of the things observed was that the spiral flow usually found in ducts fed by a propeller fan has a pressure gradient which increases from the center outwards; also, that the velocity gradient may also increase outwards. We then have induced whirls at the core of the stream, while the skin friction vortices at the periphery are accentuated, and the total energy loss is considerable. The cure is to insert straighter vanes in the duct as near the fan as possible. One redeeming feature of such spiral flow, however, is that it will fill an expansion cone of higher angle than will true axial flow.



ARRANGEMENT OF FAN AND CONE FOR HIGH HEAD AND HIGH EFFICIENCY.

Another point brought out was that a propeller fan may be made to operate efficiently under a head much larger than is used commercially. The authors advocated the use of wood-blade fans in connection with a design such as that illustrated herewith, pointing out, among other things, that wooden blades afford a better aero-dynamic shape and better efficiency than is usual in metal blades.

The paper concluded with illustration showing an interesting application of air flow principles in connection with electric desk fans whereby a widely diverging blast can be procured.

Ship Ventilation.

Mr. Still started off by saying that the little standardization that had been established in the way of ventilating ships, and only battleships, at that, had been upset by the introduction of poison gas. He then took up the prac-

WIND TUNNEL USED IN HIGH-VELOCITY AIR-FLOW TESTS.

tice followed in various classes of ships, especially passenger liners which, he said, are usually provided with means for obtaining an adequate supply of fresh air throughout all parts of the ship, wherever needed, especially when the ship is under way. Several views were included of typical equipment. Sometimes steam jets are used to inject moisture into the air.

As showing some of the variations of ship from land practice, Mr. Still stated that the volume of air handled for ventilating ships is usually from two to five times the quantity handled in land practice. Also fans for ventilation aboard ship can be run at higher speeds and air driven at greater velocities, because absolute noiselessness is not so essential. A multiplicity of abrupt turns and elbows in the ducts is frequently found, as well as long horizontal ducts when they could have been substituted to advantage by three or four good vertical fresh air shafts.

Mr. Still also discussed the equipment of refrigerated ships, cattle ships, general freighters and lake and river steamers. In the case of cattle ships, the war has taught the wisdom of ventilating such vessels. On the best types of river and sound steamers the McCreery system is used and he recommended the use of this system especially on ships sailing in the tropics.

Automatic Control of Temperatures.

Mr. Brown's paper related to high temperatures, such as those in industrial furnaces and ovens. The waste in this direction, he said, is very great. During the past few years the automatic control of high temperatures has been rendered comparatively easy through the use of mercurial thermometers having platinum contacts installed in the glass stem of the thermometer. When the mercury rises or falls to predetermined points, an electrical contact can be made to operate a switch or valve. These same contacts can be applied to nitrogen-actuated long-distance thermometers or to the various types of thermo-electric pyrometers for high temperatures. Illustrations were included of the Brown high-temperature pyrometer and of the automatic valve, operated by a switching mechanism controlled by the pyrometer.

Theory of Heat Losses from Pipes Buried in the Ground.

The fact that very little information is available regarding the theory of heat losses, from pipes buried in the ground lent special timeliness to this paper. Director John R. Allen, among other things, that:

The heat loss from a pipe is not proportional to the external surface of the pipe and that the heat loss per square foot of pipe in small pipes is very much larger than the heat loss per square foot in large pipes.

The heat loss per linear foot of pipe becomes smaller relatively as the pipe diameter increases, so that a 16-in. pipe loses, but very little more heat per linear foot than a 12-in. pipe. In practice, therefore, it makes very little difference in the heat loss whether a 12-in. or a 16-in. pipe, is used, especially in dry ground.

The heat loss from a pipe is not proportional to the thickness of the covering and that there is very little advantage to be gained in a good covering in increasing the thickness of the insulation to more than 2 in.; in most cases, with a good covering, it would appeaar that 2 in. of covering is all that is necessary.

The depth to which a covered pipe is buried in the soil makes very little difference in the heat loss, provided the center of the pipe is 2 ft. or more below the ground surface. Beyond 2 ft. in depth, unless the pipes are very large, the heat loss from the pipes remains substantially the same for all depths.

The heat loss from a pipe is not proportional to the conductivity of the covering, as the conductivity of the ground is as important a factor in the heat losses as the conductivity of the covering.

Poor covering in dry ground will give better results than good covering in wet ground. It is not possible, therefore, to guarantee the heat loss from a covering in the ground, as such a guarantee involves guaranteeing the conductivity of the ground.

In discussing the theory of heat loss, Dr. Allen stated that there is a fundamental difference between heat loss from a pipe in the ground and a pipe in the air. With a pipe in the air, either bare or covered, the final loss to the surrounding air and object occurs by conduction and convection. With a pipe buried in the ground, either bare or covered the final heat loss is by conduction through the earth envelope surrounding the pipe. Three cases were then considered, one with bare pipe buried deeply, another with covered pipe buried deeply, and a third with covered pipes close to the surface so that its temperature affects the surface of the ground in contact with the air. Other points taken up were the effect of the size of pipe, effect of different thicknesses of covering and coverings with different conductivities.

Although Dr. Allen's discussion was largely theoretical he showed that, for instance, in the case of ground temperatures at different distances from 5-in. bare pipe buried in the ground, the computed results came very close to test results.

In conclusion he pointed out that it is not possible for a manufacturer of pipe coverings to guarantee the loss of heat from the covering when placed in the ground, as this depends very largely on the condition and kind of ground. He said it would first be necessary to study the conductivity of different soils and he suggested this as a worthy field of research. Further tests are now being made at the University of Michigan on losses from bare pipe underground.

Dissipation of Heat by Various Surfaces.

Mr. Taylor recounted the experiments which led to the discovery, at the same time that V. S. Day of the University of Illinois, was making a similar discovery, that warm-air furnace pipes lose more heat when coated with the usual sheet asbestos than when left bare, (reported in THE HEATING AND VENTILATING MAGAZINE for January, 1920). Mr. Taylor went on to describe the apparatus he used in measuring heat losses and presented tables and charts of the results obtained, including heat losses from various tin and galvanized-iron surfaces, the effect of air velocity on dissipation of heat and on the effect of angle of incidence on dissipation of heat.

Industrial Electric Heating.

Mr. Scott told how uniformity of temperature, obtained with electric heaters for baking and drying ovens, had brought this method into general use. He described in detail the forms of heaters used in connection with the baking of enamel or japan, on any metal and other processes requiring a baking oven. He said the ventilation of the ovens is one of the most important considerations in laying out a heating system. Before the adoption of electric heat, ovens were ventilated from the ceiling. This, he claimed,

is fundamentally wrong, but necessary where gas is used. He advocated floor ventilation. He gave equal importance to the matter of automatic temperature control of the ovens and his paper illustrated a typical control panel for operating four semi-continuous conveyor ovens. He said it was rapidly becoming the practice to install individual exhaust fans in connection with each oven to insure proper ventilating conditions.

Electric heat, he said, is clean, there are no objectionable gases to vitiate the air, there are no products of combustion to collect on the work and heat can be applied in the most direct and economical manner.

Better Planning Needed for Departmental School Buildings.

One of the most remarkable omissions in the literature on school building, states Frank Irving Cooper, chairman of the Committee on Standardization of Schoolhouse Planning, of the National Education Association, in a recent report, is the absence of any work upon the economical utilization of floor space in a modern departmental school building. The investigations undertaken by his committee, he said, revealed a condition of lack of interest and study on the part of those responsible for the school plan that passes belief.

Spaces in many of the school plans sent to the committee for tabulation were marked as being used for purposes for which they were totally unsuitable. Spaces were marked for activities which, if carried on in the areas assigned to them, defied all sense of proportion in curriculum and class unit.

In order to secure more accurate comparisons the committee drew up a series of rules for the measurement of the school plan which are offered as a general standard method. They are as follows:

RULE 1. COMPUTING AREAS.

A. Line of measurement for area of all floors is to be taken at the outside face of exterior walls. Deduct all recesses which are the full story height.

B. The area of basement floor is to be measured from same line as outside wall of first floor.

C. Compute each floor and mezzanine separately.

D. The area of light wells, courts, air shafts, etc., are not to be included in floor areas.

E. In rooms and auditoriums which extend through more than one story the area of such space shall be deducted from the floor or floors through which it extends.

F. In the case of an assembly hall or gymnasium which has a balcony, the area of such balcony shall be taken separately.

G. In figuring wall or partition areas, no door or window openings shall be deducted but the wall shall be figured solid as though no openings occurred.

H. Exterior walls and interior partitions are to be figured the finished thickness including any lath and plastering.

I. Flues are to be figured to include all surrounding walls and partitions except interior walls and partitions figured under H.

J. Where closets or bookcases or dead spaces occur in a bank of flues, same are to be figured in as flue area.

K. Stairs extending a full story in height are to be taken as stair area. Steps not a full story in height are to be taken as part of the floor area of the room or corridor in which they occur.

L. Large piers occurring in rooms are to be deducted from floor areas and added to wall areas.

M. Chimneys are to be figured in as flue areas.

N. Area of each individual space is to be taken separately in accordance with schedule.

O. Areas of arcades, open porches, uncovered corridors, pergolas and open air theatres or auditoriums, are to be figured separately.

RULE 2. COMPUTING CUBICAL CONTENTS.

A. Ascertain the cubical contents of the building by multiplying the area of the first floor computed by Rule 1, by the height of the building from the underside of basement floor to the mean of the roof.

B. In buildings whose basements are not entirely excavated, multiply the area of the first floor computed by Rule A (areas) by the height of the building from the underside of the first floor to the mean of the roof. To this content add the cubical content of any space between the underside of the first floor and the surface of the excavation, and in addition add the cubical contents of any partial basement which may be found in the building.

C. When portions of the building are built to different heights, each portion is to be taken as an individual unit.

D. Projecting entrance porches are not to be included.

E. Porches, covered verandas, used for school activities and open air rooms and auditoriums are to be included.

After studying the plans of some 200 school buildings, the committee developed a standard or measure, called the candle of efficiency, with six main divisions, which is now being used in checking school plans in some of the most important architects' offices.

The percentages of the candle of efficiency have given standards by which architects reach a better understanding as to whether their plans are well designed for economy of floor space. By comparing tabulations of their plans with the findings of this candle, they learn where savings must be made to produce an economical plan.

DEVELOPMENT OF RULE FOR DETERMINING SIZE OF NEW SCHOOL BUILDING.

To develop a method, or rule, by which the general size of the new school building may be determined, after the superintendent has prepared his program, is the problem now before the committee. If a method or rule can be evolved that will work the greater number of times it is tried, the planning of school buildings will no longer be a matter of opinion and guess.

Months of study of this problem and the trial and elimination of numerous methods in the practical work of the architects' office, gradually produced a certainty that facts which might be obtained by the following tentative rule were the basis upon which to plan.

Compute the probable maximum number of pupils in each grade for which the building is to be planned. Each study and special activity for each grade, with the period allotment per week, is to be worked out by the superintendent. Determine the maximum number of pupils that would probably take each study and special activity. The maximum number of pupils taking a subject is multiplied by the number of periods per week allotted to that subject. This product is divided by the average number of pupils in a group or class in that subject. This gives the number of room-periods needed in that subject. This is divided by the number of periods in which a room can be used in a week. This gives the number of rooms required for that subject. In the last computation any fraction is counted as a whole number.

The result is then charted for use of rooms. First is shown each room with its distinctive purpose, then any supplementary or duplicate use that might be made of the room, then the home room pupil accommodation, and then the teacher use of the room.

Charting the school, first by special activities and studies and then by rooms and their possible multiple use, shows what margin for flexibility will be required in determining the final number of class and study rooms.

The Heating and Ventilating Magazine
A MONTHLY JOURNAL of ENGINEERING PROGRESS
Member of the Associated Business Papers Inc.
Member Audit Bureau of Circulations.

Vol. 17 August, 1920 No. 8

Published Monthly at Cooperstown, New York, by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices
1123 Broadway, New York
A. S. ARMAGNAC . . . . . President and Editor
GUSTAVE PETERSEN, Secretary-Treasurer and Business Manager

European Representative
W. G. HOLLINGWORTH, Bessemer House, Adelphi, London, W.C

Subscription	$2.00 per year
Canada	2.25 per year
Foreign Countries	2.50 per year
Back numbers	25 cents each

IT IS a pleasure to record the keynote of progress sounded by the heating contractors' national association. While it is, perhaps, too much to expect that the program of advancement mapped out at its recent annual convention will be carried out in full, still the mere fact of its adoption marks a gratifying departure from the limited vision which has so long been its dominating characteristic. In fact, the wonder is that with so much accomplished in a broad way towards the betterment of the industry, the association has been content for these many years to confine itself, for the most part, to a policy which was so well expressed in the association's former motto, "Who helps me, I help."

To mention only a few of the progressive movements which the association has now undertaken, there is, first, the proposition of compiling a "Cost and Data Book," to contain both engineering data and detailed information as to the proper method of estimating costs and overhead business expense, and loose-leaf data covering list prices, discounts, net cost and selling prices, including overhead business expense and profit.

Second, and even more important, if possible, is the effort which the association proposes to make towards filling the ranks of competent steam fitters. As stated in its "Declaration of Principles," the subject of apprentices is one of very great importance, as it is a well-known fact that there is a great shortage of competent journeymen steam-fitters and it is also generally conceded that the present apprentice system is not producing men either in sufficient numbers or with the required skill to make up for the natural decrease which takes place in the ranks of the journeymen. This matter, as well as that of the mechanics themselves, is to be placed in the hands of a "Labor Conference Committee," whose duty it shall be "to consider such labor problems and conter with such representatives of our employees as may from time to time desire to submit to this committee matters which may be of mutual interest." Already the association's representatives have met in conference with those of the international steam fitters' union.

In connection with the mechanics a suggestion is made in the same "Declaration of Principles" that will no doubt meet with wide approval, to the effect that labor unions should classify their members and that the men should be paid for what they know and by the use of that knowledge; that is, for what they can and are willing to produce. While approving the establishment of a fair day's pay for a fair day's work the unions are urged not to limit their members to this amount, but to provide that when a skilled mechanic has demonstrated that he is entitled to receive an increase, through greater ability or increased productivity, or both, he shall receive it. The suggestion goes even a step further. The unions are urged to classify those mechanics who are less skilled and establish a wage according to what they are really worth, not permitting them to receive the wages of a skilled mechanic until they have clearly demonstrated that they are entitled to receive such wages.

Equally important are the "declarations" on the apprenticeship situation which it is proposed to have handled by the Labor Conference Committee.

WE DWELL on these "declarations" at some length because they cannot be considered as merely empty phrases since they are to form subjects for personal discussion between representatives of employers and employees. It is, in fact a most significant thing that the heating contractors' association has taken the step of meeting in conference with the labor unions, and that the present president of the association can say of the special meetings of this sort held during the past year; "They (the union's representatives) appeared to our committee as actually endeavoring to find a solution for past differences and working for the betterment of the industry as a whole."

There are in all sixteen principles laid down by the association, some of which have the familiar ring of bygone days. Their whole, import, however is given a new significance by the concluding clause which is worthy of quotation in full:

"The principles set down," it reads, "are merely expressions of opinion, not involving, directly or indirectly, any compulsory measures against members or others by the exercise of disciplinary powers or through combined action of any description. In other words, the foregoing declaration of principles is the first step in an educational campaign to bring about better conditions in the industry, in the interest of the employer, the employee and the public."

HEATING AND PIPING CONTRACTOR'S NATIONAL ASSOCIATION

SUPPLEMENTARY REPORT OF RECENT ANNUAL CONVENTION

Many of the most important actions taken at conventions of the Heating and Piping Contractors' National Association are put through during executive sessions. As the association's policy, unlike other similar bodies, is to withhold a portion of this material until after its publication in the Association's *Official Bulletin*, it has not been possible until now to present an adequate report of the convention.

As stated in our first report, the matter of labor occupied a prominent place in the discussions and a lengthy declaration of principles was adopted, favoring, among other things, the appointment of a Labor Conference Commitee to confer with "representatives of our employees." The resolutions point out that in the conduct of heating work, three parties are vitally interested, the employer, the employee and the public. In the operation of the combination shop, doing both steam fitting and plumbing, the condition often arises when one of these trades is considered to the detriment of the other, with the result that plumbers are sometimes used to do steam fitters' work, or vice versa. It will be the duty of the Joint Conference Committee to make every effort to classify all work belonging to plumbers or steam fitters so as to provide equitable jurisdiction between the trades, both employer and employee to be governed by this classification.

The association takes the stand that general building contractors should be discouraged from setting up a department for installing steam heating, power piping and sprinkler work, and should, if possible, be persuaded to confine themselves to those branches of work where they can render the best service to the general public.

Ventilating work, it is claimed, should be included in the work of the heating contractor and should either be installed directly by his own organization, or, if the heating contractor is dependent upon the sheet metal contractor for his proposal as to the cost of the work, then the work should be turned over to the sheet metal contractor for execution.

It is declared to be to the best interests of the heating and piping industry, as well as to the public, not to have manufacturers and supply houses furnish plans, measure up jobs and furnish material for anyone who is not legitimately engaged in the heating and piping industry, for the reasons that the employer is thereby denied the business which should properly pass through his hands, the employee is denied the labor which belongs to him, and the public is imposed upon by having its work performed by incompetents. Every legitimate effort, it is added, should be put forth to discourage the practice of corporations that invite and take advantage of the service rendered by such manufacturers and supply houses, with a view of installing their own work.

The practice of many stationary engineers in purchasing materials direct from the manufacturer or supply house and either doing the work themselves or employing men direct for that purpose, instead of securing men from a regularly established shop, is stated to be detrimental to those engaged in the heating and piping industry.

The practice of including steam heating, power piping and sprinkler work in the general building contract, states the declarations, has resulted in many cases in sacrificing the rights of the sub-contractor and oftentimes in subjecting him to methods of unfair competition brought in only to set the price level. Delayed payments and loss have resulted while the sub-contractor's capital is employed by the general contractor to carry on more work than he is financially competent to undertake.

Manufacturers and jobbers who sell heating specialties to the consumer with the knowledge that the consumer intends to install them with his own forces, the association declares, is following a policy which is detrimental to the best interests of the buying public, and to the interests of the heating contractor upon whom the manufacturers are largely dependent for the sale and successful installation of these specialties.

Another declaration urges manufacturers in advertising their goods to confine themselves to such matter as may tend to advance their sales, omitting offers to draw plans, furnish estimates or other inducements "all tending to create relations which we regard as unnecessary, undesirable and detrimental to the interests of all concerned."

"House-wrecking companies," it is claimed, should not attempt to design steam heating work in their effort to market either new or second-hand heating materials.

Where a contractor has not been fully paid for his work, every proper and legal effort, it is held, should be made by those coming in later contact with the owners, or with the building project, to impress upon them their duty to see that the original contractor receives in full any balance still due him upon the work.

Combined efforts of the association and of the United Association of Plumbers and Steamfitters is urged to combat proposed radical and unsound legislation and to support all good legislation.

Air washers, it is maintained, should be erected in position by the properly constituted journeymen to do such work, and the piping connections to same should be the work of the steam fitter.

LABOR UNIONS SHOULD CLASSIFY THEIR MEMBERS.

On the subject of mechanics, the declarations urge the unions to be jealous of membership in their respective bodies. Labor, it is declared, should be classified and men should be paid for what they know and, by the use of their knowledge, for what they can and are willing to produce. After establishing a fair day's pay, the skilled mechanic, it is claimed, should not be limited to this amount. Mechanics who are less skilled should also be classified and paid what they are really worth.

Apprentices, it is declared, should receive the organization's best thought and prompt attention. It is a well-known fact that there is a great shortage of competent journeymen steam fitters and it is also pretty generally conceded that the present apprentice system is not producing men either in sufficient number or with the required skill. In addition to having the necessary qualifications, the declarations recommended that a well-defined program of work should be mapped out for him and that he should be shifted from one shop to another to broaden his experience. Provision, it is added, should also be made for weeding out apprentices who, after a

sufficient interval of time and opportunity, are obviously not fitted for the work. Where union labor conditions prevail, it is recommended that joint boards be encouraged in each locality, to be composed of equal numbers of employers and steam fitters, to examine and pass upon the qualifications of aspirants and to follow the apprentice's progress.

REPORT ON STANDARDIZATION.

The completed work for this year of the Standardization Committee, as reported by the acting chairman, Stewart A. Jellett, was the preparation and final approval and adoption of the "Conditions to Accompany Proposals for Steam and Hot Water Heating, Piping," etc., affecting bids submitted by members of the association.

STANDARDIZATION OF PIPE THREADS IN ABEYANCE.

Regarding the work of the Joint Committee on International Standard for Pipe Threads, Mr. Jellett stated that the work has ended for the time being without the achievement of satisfactory results because "it developed that a large majority of British manufacturers are unwilling now to accept the American Standard Pipe Thread, first, on account of the sacrifices they would have to take at home; second, because of their very large export trade in thin-walled pipe, which does not permit of the use of American Standard Thread in the large sizes (2½" in. and over); and, third, because they feel that their prestige abroad would be affected by the adoption of a purely American standard."

The committee has also had under consideration for some time the publishing by the association of a Cost and Data Book. It is proposed to have this include a certain amount of engineering data, detailed information on methods of estimating costs and overhead business expense and a price or billing book.

A resolution was passed by the convention favoring the idea of publishing a Cost and Data Book and providing that a referendum vote be taken on the scheme to see if the members would give the project the necessary support.

WORK OF THE HEATING ENGINEERS' RESEARCH BUREAU ENDORSED.

Hearty endorsement of the work being done and to be done by the Research Bureau of the heating engineers' society was given concrete form in a resolution in which it was authorized and recommended that the yearly contribution of the association be in such amount as approved by the board of directors and that support of the movement by individual members be encouraged.

ASSOCIATION TO CO-OPERATE IN FRAMING CODE FOR TESTING HEATING SYSTEMS.

In connection with the code for testing low-pressure heating systems which is referred to in the association's "Proposal Conditions" but which has not as yet been framed by the heating engineers' society, a resolution was passed that the association's Committee on Standardization should co-operate with the committee of the American Society of Heating and Ventilating Engineers in formulating the code.

Finally, a resolution was passed stating that the association does not look with favor upon the practice of the United Association of Plumbers and Steam Fitters which admits to its union plumbers and steam fitters who are employed as maintenance gangs in factories, mills and other places, which maintenance men work for lower wages than members of the United Association receive from contractors regularly established in the heating and piping business.

Canadian Contractors Discuss Heating Systems and Trade Extension.

Trade extension in Canada occupied a prominent place in the annual convention of the Canadian Society of Domestic, Sanitary and Heating Engineers, held in Toronto, Ont., June 8-10.

The discussion of heating systems was contained in the report of the Heating Committee, Telles Latourelle, chairman. It referred especially to the practice followed in the Province of Quebec.

"It is always difficult," stated the report, "to obtain or convince a client that the cheapest apparatus is not always what should be installed, and it is very often the fault of the heating contractor, who is very often afraid to ask the price required to make and assure a good job. What I wish to demonstrate is the advantages derived from a well-installed heating system, either water, steam or air, according to the conditions of the building and the adaptability of the system for the construction.

"We have had to witness and inspect some installations of heating plants in private houses which were simply abominable and should not be called a heating apparatus. A steam fitter should be more scrupulous of his work, and have at heart the installation of a heating system worthy of a steam fitter, and by so doing we will advance and educate the helper steam fitter and also encourage him in learning his trade.

WATER HEATING.

Water heating systems are not generally installed according to rules outlined by the capacity of the sizes of piping. Some parts are so overloaded and others so deprived of utility that they render useless the workmanship. A well-balanced heating system is always certain to give more or less satisfaction should it be short of radiation. It it also necessary to demonstrate to the client the best heating system that should be installed in a private house, and I am of the opinion that hot water is more healthy than a steam apparatus, although it is more expensive to install, but far cheaper to operate.

"I would take advantage of this occasion. We have for a number of years past devoted our energy to the forced water heating system, and we have met with very good results where installed and especially where centralization is made; that is, where a number of large buildings are isolated, it is of a great advantage to the consumer for saving of fuel. In some cases it has resulted in a saving of 35% of the fuel and was found cheaper to operate.

"In centralizing a new plant of heating it is a recognized fact that specialties necessary to the forced system will somewhat increase the cost of installation, but the satisfaction derived therefrom will repay in time by the saving of fuel alone. The forced water system of heating will guarantee a good circulation of the water throughout the radiator and more especially in pipe coils where most of the time only two-thirds of the radiation is heated.

"After considering all these facts we have adopted a system and have also obtained the patent rights for Canada and the United States and have annexed with it a water heater, which forms part of the forced water heating system, which can be installed for heating any kind of a building, from one-story to 40 stories, from 10 sq. ft. to any quantity, and from one building to any number of buildings."

APPRENTICESHIP COMMITTEE'S REPORT.

The ever-present problem of the apprentice was taken up in a special report in which it was stated that a very small percentage of employers in Canada employs boys to learn the trade. It was proposed that a joint com-

mittee of masters and journeymen be appointed, to be known as the Apprenticeship Committee. Boys wishing to learn the trade could apply to this committee and be placed by the committee with applicants for boys. Parents or guardians would be expected to be a party to any agreement made. It was proposed further that the Apprenticeship Committee should have full control of the boy from the time he starts to learn the trade until he becomes a journeyman. He would not be allowed to leave one shop and go to another unless permitted by the committe. The committee would have the power to call the boy for examination at any time, and, if necessary, investigate and find the cause of the trouble. Every boy, it was stated, should have at least three months' probation before being registered as an apprentice, to make sure he had the inclination and qualifications to become a mechanic.

The committee recommended that every employer throughout the country should interest himself in the apprenticeship problem and take on as many boys as his business will allow.

"The great need of our trade today," concludes the report "is education. We have tried for a great many years to educate the masters and the men, which has not been very successful. Now let us start at the foundation, which is the boy."

PROPOSED TRADE EXTENSION MOVEMENT.

An entire afternoon session was devoted to a discussion of a trade extension movement. Both delegates and manufacturers participated in the discussion. President Maxwell urged the manufacturers to adopt a policy of getting into closer touch with the shops and to help the contractor to run his shop to the best advantage.

The manufacturers' viewpoint was presented by Fred. Armstrong who stated that, in his opinion, the manufacturers were glad to sit in conference with the contractors. He urged the establishment of a trade extension bureau similar to the one in operation in the United States. The manufacturers, he said, are prepared to help support such a bureau.

WRINKLES

How To Determine The Arrangement And Direction of Concealed Piping.

When extensive changes are required to the existing piping concealed in an old building and there is no available record, it is sometimes difficult to determine, the direction such pipes take, to what other pipes they connect or discharge and various other matters which should be known to intelligently lay out the new work.

In such cases, a dry powder preparation called aniline yellow uranine may be obtained from some chemical store. This powder will impart a green color to any water in which it is placed and in this way the pipes may be traced to their connections merely by placing the mixture of water and powder in a pipe and then noting at what outlet it appears.

The Correct Use of Thermometers.

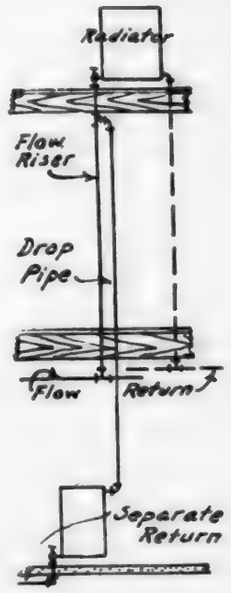
The indicating thermometer, while a very useful instrument for many purposes and familiar to most of us, is often incorrectly used. In taking the temperature of a room, the air is not equally warm throughout while there may be from 10° to 15° difference between floor and ceiling. It should also be remembered that a stove or radiator by direct radiation may cause the thermometer to read much higher than else where in the room. Consequently, room thermometers should be located on an inside wall about 4 ft. from the floor and away from ventilation flues. A thermometer brought suddenly from one temperature to another will lag and may not give the correct reading until after 10 or 15 minutes have elapsed or even much longer, if mounted upon some heavy ornamental object.

Thermometers for outside use should be kept 4 ft. from the ground and located either in a well-ventilated box built to protect the instrument from the direct rays of the sun or else placed in an open shady place, as at the north of a building, but several feet from the walls. Thermometers mounted 2 or 3 in. outside of windows may read several degrees high in cold weather.

Method of Connecting Radiators Below the Flow Main of Gravity Water Heating Systems.

Radiators of a gravity water heating system, when installed below the flow main on the same level as the boiler in the basement, should be supplied from a drop pipe connected from a point near the top of a convenient flow riser. The riser is increased in size so as to supply both radiators and a separate return is run from the lower radiator back to the boiler, as shown in the sketch.

The velocity of flow depends on the difference in weight



CONNECTING RADIATORS BELOW FLOW MAIN OF GRAVITY WATER HEATING SYSTEMS.

or head of water in the flow and return risers, the water in the return risers being denser and weighing more per cubic foot than the water in the flow risers. Consequently, the motive power for circulation is greater when connected as sketched than if taken directly from the flow main, while advantage is also taken of the greater flow which is naturally present in the risers to radiators on upper floors.

The Proper Design of Firing Tools.

Doubtless there are as many types of tools used in handling fires as there are methods of cleaning such fires, but at least one feature of the design should predominate, that of lightness consistent with strength. This may be obtained by making the bodies of the tools of iron pipe welded to their handles and fire ends, with the exception that the steel plate of the ash hoe is riveted directly to the rod or to a solid piece of round iron. The latter tool may be welded to a 1-in. pipe, instead of the ¾-in. rod. In fact, some designers, prefer the use of pipe rather than the rod, as shown in the case of the fire rake and ash hoe. Likewise, the fire end of the slice bar is sometimes made of greater length and width, being about 2½ in. wide and 30 in. long.

A set of firing tools is shown in Figs 1, 2 and 3, the ash hoe and slice or slash bar being used mainly for cleaning fires, while the fire rake is used only for leveling the fuel bed. A blacksmith can quickly make up these tools and with reasonable care, they will last a long time.

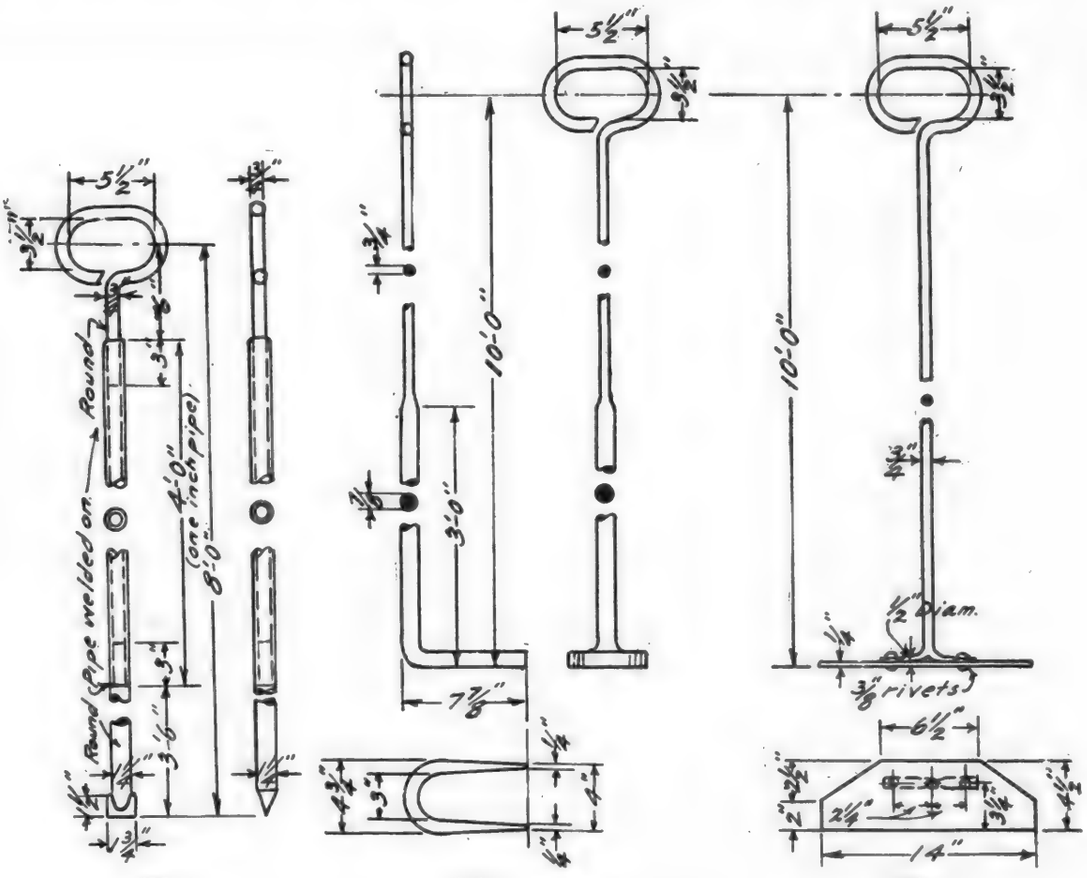


FIG. 1. FIG. 2. FIG. 3.

PROPER DESIGN OF FIRING TOOLS.

A Peculiar Explosion in the Furnace of a Heating Boiler.

Gas explosions of greater or less intensity occur under certain conditions even in furnaces of domestic heating apparatus. likewise boiler explosions due to other familiar causes, but recently an explosion in a steam heating boiler took place from a source heretofore unrecorded.

According to the owner no fire had been built in the furnace during a few days of mild and rainy weather, also a slight amount of water from the outside had seeped into the cellar. With the visible disappearance of the water and the coming of a colder day, fire was started in the furnace and, about three hours later, banked with old coal, all doors and dampers being closed except the slot in the firing door. The smoke-pipe damper had a small hole in the center so that a slight draft could take place through this damper even when in a "fully-closed" position. Thus the conditions were more or less ideal for a gas explosion but the furnace was not tampered with subsequently, and the effect of the explosion would seem to point to a somewhat different cause.

A short time after banking, the firing, ash-pit and clean-out doors were blown open, although the fire was not disturbed, and the cement floor within the ash-pit to the depth of ½ in. was shattered. The explosion had a similar effect underneath and immediatly outside the point of contact between the furnace base and the floor.

When the fire was banked, hot coals had dropped from the grate to the floor and evidently these had caused small globules or a film of water doubtless still present under the cement, which formed pockets of steam of sufficient pressure to create the explosion.

MODERN PRACTICE IN VAPOR HEATING

EDITOR'S NOTE: For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or thermograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.

XXV.—THE ILLINOIS SYSTEM.

The Illinois modulating or vapor system, while having all the features of the usual low-pressure modulating heating system, goes a step further in being able to operate a large portion of the time below atmospheric pressure, thus being a true vapor system, and giving the well-recognized fuel economy of a vapor system. Another unusual feature of the Illinois system is that it provides for the return of condensation to the boiler against any boiler pressure up to 10 lbs. While the returns are open to atmosphere for the discharge or venting of air from the system, the vent is sealed to prevent air pulling back into the system. The Illinois system is a combination of the essential features of both modulating and vapor systems, and of open and sealed return systems.

The piping above the basement is the standard two-pipe, a supply main with branches, risers and laterals connecting to all radiators, and a return system of piping from all radiators back to the boiler, as shown in the typical plan, Fig. 1. The supply or feed valve to each radiator is the Illinois modulating valve shown in Fig. 2. This value requires but a half turn from full open to closed position, and a dial and indicator show the position of the valve. The valve has a machined spool with triple thread making it smooth and easy to operate, giving maximum port opening in one-half turn. In common with most systems of this class, water radiation is preferred in order to put the modulating valve at the top of the radiator for the sake of accessibility.

The return end of the radiators is equipped with the well known Illinois thermo trap, shown in Fig. 3. These traps are sensitive and prevent steam from passing into the returns, which, it is claimed by the manufacturers,

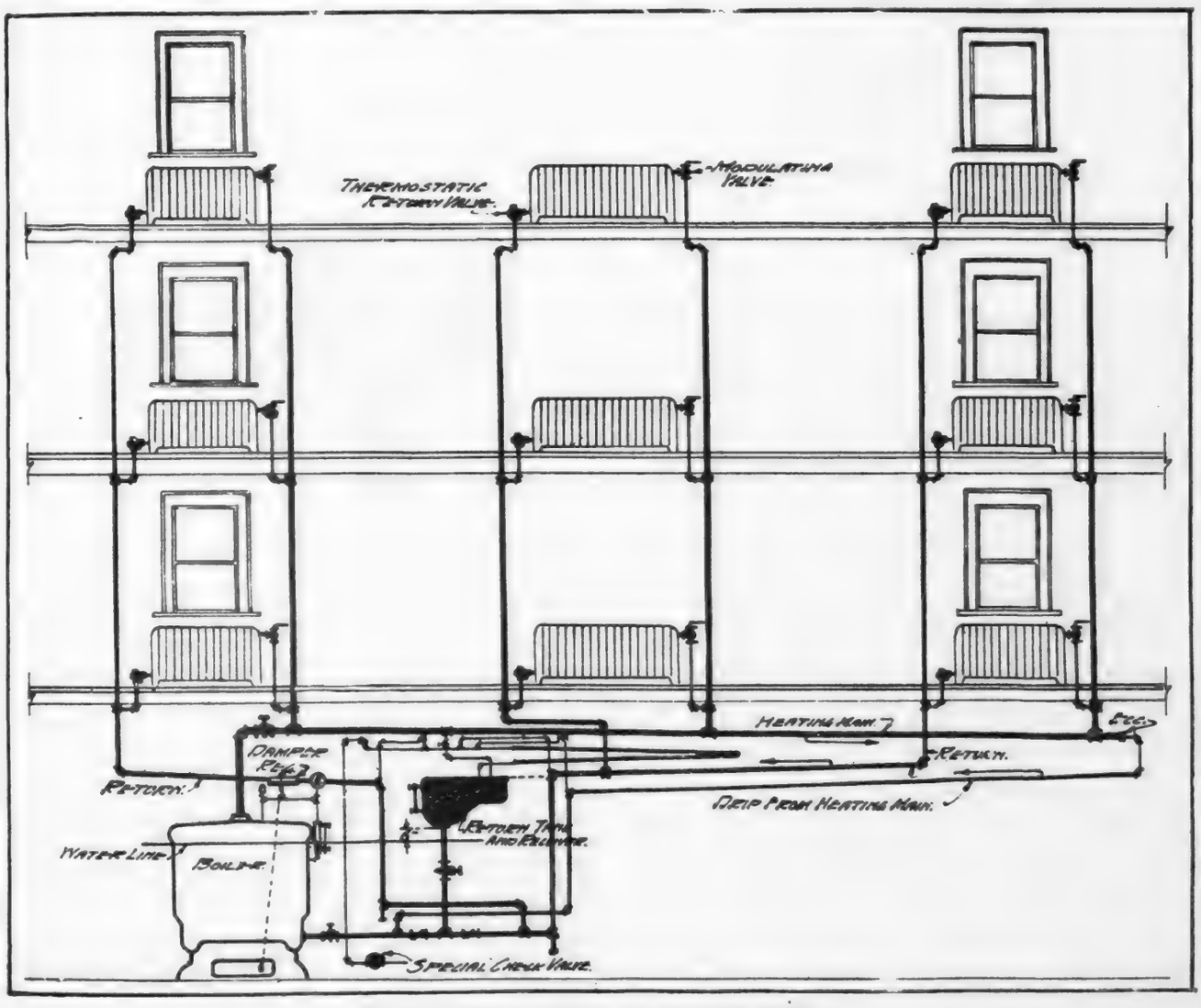


FIG. 1—TYPICAL LAYOUT OF ILLINOIS SYSTEM.

keeps pressure out of the returns, and makes it possible to maintain less than atmospheric pressure or vacuum on the returns, enabling the system to circulate quickly.

The basement return mains, instead of being brought back to an air-liberating device alone, are equipped with a return receiver trap, which, in addition to liberating the air, provides a positive means for putting the water of condensation back into the boiler, against any pressure possible on the boiler—(10 lbs.). This return trap (see Fig. 4) consists of a float to actuate the rocker arms and weights which alternately open the air vent valve to permit escape of air from the system when no water is in the receiver, also to close the air valve and open the steam valve when the receiver is full of water. This puts the boiler pressure on top of the water, equalizing the boiler

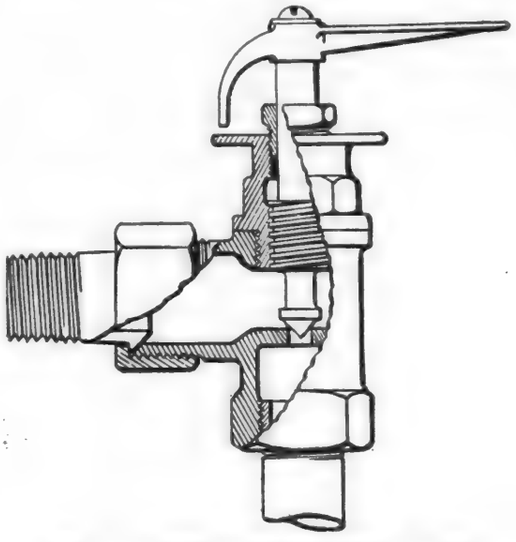


FIG. 2—ILLINOIS MODULATING VALVE.

pressure so that the water returns to the boiler by gravity.

The importance of installing a return trap on all vapor systems which use automatic return valves on the radiators to keep steam out of the returns, is emphasized by the manufacturers, for while a damper regulator, which is also furnished with this system, will ordinarily control the boiler pressure, as is well known there are times when the pressure will run up even to 8 or 10 lbs. When this happens the return condensation is held up in the return mains and even in the lowest radiators, preventing its return to boiler until the pressure goes down, and this has resulted in many cracked boiler sections. With a proper return trap the normal operation of the system goes on, regardless of the fluctuations in boiler pressure.

The air, after leaving the return trap, passes through an Illinois vent seal valve, shown in Fig. 5 which offers no resistance to the out passage of the air but prevents air coming into the system, so that the system does not fill up with air as soon as it cools off. This not only induces vapor into the radiators from the boiler, which vapor ordinarily is not utilized, but it is not necessary to force air out of the system every time it is fired up. In this way very quick circulation is secured.

The supply mains are dripped where necessary through Thermo drip valves into the vapor return mains, but the end of a loop may be returned through either a wet or dry return direct to the boiler. If a wet return is used, an air vent valve discharging into the vapor return main is installed. This air valve is a thermostatic valve, closing against steam.

The vapor return piping, that is, the return from radiators, should be kept up as near the ceiling of the basement as possible, so as to give sufficient headroom for the return trap to be installed 6 in. or more above the water-line of the boiler.

Great flexibility may be secured with the Illinois system. It has been installed in a variety of buildings, from residences to 17-story buildings, and in others having hundreds of radiators. In each type of installation the

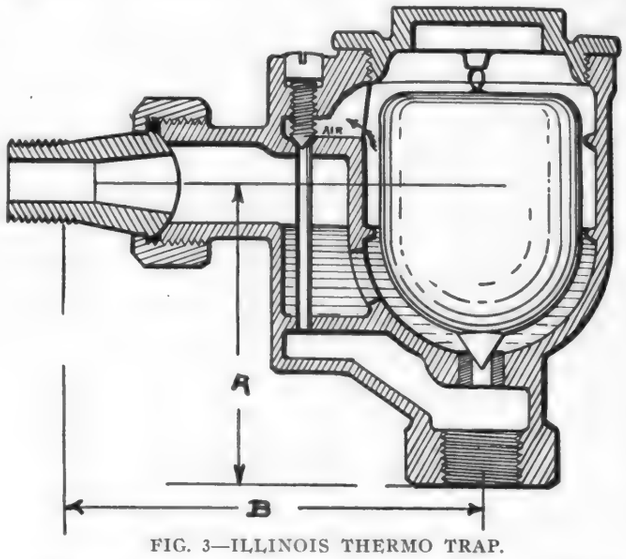


FIG. 3—ILLINOIS THERMO TRAP.

circulation has been found to be as rapid as though a vacuum pump was installed, and remarkable economy secured from operation under vapor conditions—below atmospheric pressure. There are also combination jobs installed where some of the basement radiation was placed below the boiler water-line and condensation pumps used to handle the returns from the low radiation, the balance of the building being handled as previously described.

FIG. 5—ILLINOIS VENT SEAL VALVE.

The Illinois system specialties used are manufactured by the Illinois Engineering Company, Chicago, Ill., which has the representation of being pioneers and originators in this field. While many of the essential features are patented, Illinois systems are sold without royalty charges.

Positions Open for Government Building Estimators.

The United States Civil Service Commission announces an open competitive examination for building estimators at $1800 to $2400 a year. After six months' satisfactory service appointees may be allowed the increase granted by Congress of $20.00 a month. The duties of the appointees will consist of making estimates of the cost of general building construction and maintenance, including labor, materials, and preparation of bills of material. Competitors are not required to report for examination, but will be rated on physical ability, training and experience. Applicants should apply for Form 1312, stating that the examination desired is that for "building estimator," and must file their applications by September 7.

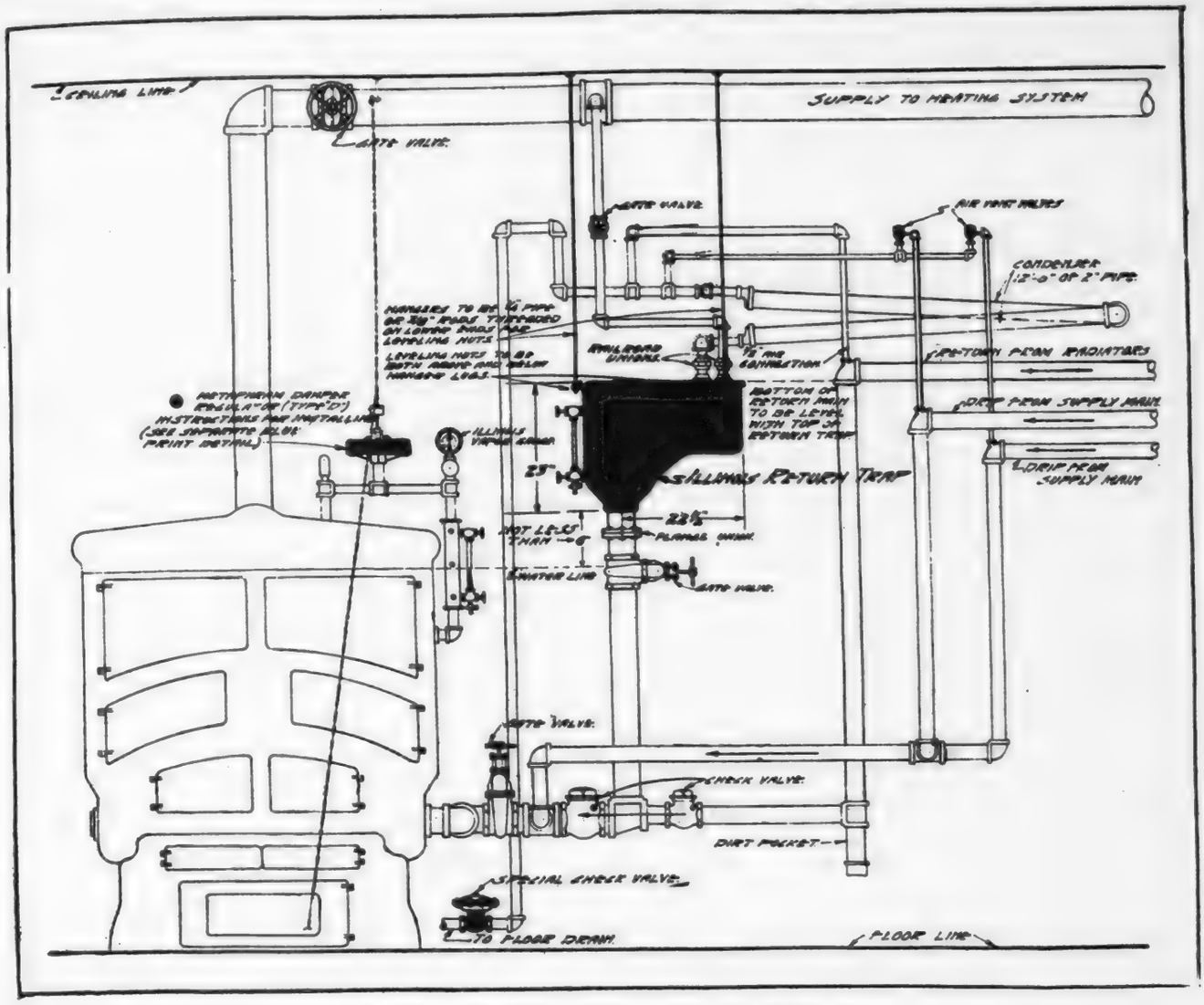


FIG. 4—BOILER CONNECTIONS, ILLINOIS SYSTEM.

LEGAL DECISIONS

Effect of Clause in Installation Contract Requiring Written Order of Architects for Extras.

An assignee of a contract for the installation of heating and plumbing in a building brought an equitable suit to determine liens, basing his right on a quantum meriut for extras which had not been paid for. The contract for the installation was a "uniform" contract, and provided that there should be no extras except on written order of the architects. Certain bills for extras were contested, the orders for which were either unsigned or had the initials on them of F. C. Reynolds, who was undoubtedly the owner's agent to see that the building was erected according to contract, but he was without authority to order extras. That was to be done by the architects, and not even by them, "except upon written order." There was no evidence that Reynolds was the "authorized representative" of the architect. It was held, Hunt v. Owens Building & Inv. Co. (Mo.) 219 S. W. 138, that the fact that the architects left to Reynolds the inspection of the details of the work, or, in other words, depended upon his being satisfied therewith, would not empower him to order extras, in the absence of evidence that the owner knew he was ordering them. The fact that after the extras were ordered and had gone into the building the architects went over the bills therefor and approved them was held not a compliance with the terms of the contract, as it manifestly contemplated that the architects' decision should be made before the articles were bought and placed in the building.

Central Station Water Heating Rates.

In authorizing an emergency rate for water heating service in Lafayette, Ind. of 27 cents per square foot of radiation per annum, to the Northern Indiana Gas & Electric Company, the Indiana Public Service Commission holds that an emergency may exist although rates formerly charged by the company yielded excessive returns, since it is not proper to penalize the present owner of the utility, which is operating at a loss for the profits under the franchise rate, for which the city was partially responsible, alleged to have been made by it and its predecessor in title.

The evidence showed that there has been no increase in the annual revenue of the company, but that the operating expense has more than doubled since 1917, and that no utility can continue to operate under that condition; and to do so could result only in deterioration and ultimate abandonment of ser-

vice; that central station water heating plants have not proven economical, and this plant is no exception to the rule; that the cost of construction and maintenance is in many cases prohibitive; that there is frequently such a material wastage of heat in transmission that either the system is operated at a loss to the utility, or the rates are so high that the consumers could better afford to install private heating plants.

"Uniform" Contract for Heating and Plumbing Installation—Final Certificate—Written Order for Extras.

In an action by the assignee under a contract for the installation of the heating and plumbing in a building under construction, it is held, Hunt v. Owen Bldg. & Inv. Co., (Mo.) 219 S. W., 138, that under a "uniform" contract for such installation, providing that all payments shall be due when certificates for the same are issued and that no certificates given except the final certificate shall be conclusive evidence of performance, a certificate of the architects that all plumbing fixtures are hereby accepted, issued before the final completion of the work and having no reference to the work done, was not the final certificate referred to in the contract, and the owner could offset for defective work. It is also held that where such a "uniform" contract for the installation of heating and plumbing provided that there should be no extras except on the written order of the architects, an authorized agent of the owner to see that the building was erected according to contract could not order extras: and the fact that the architects left to him the inspection of the details of the work and that they approved the bills for the extras which went into the building was not a compliance with the contract.

Bricked-In Furance and Heating Pipes Become Part of Realty.

The tenant of a building entered into a contract with the owner for the purchase of the building. He installed a bricked-in warm-air furnace and heating pipes extending throughout the building. Subsequently he abandoned the contract to purchase, and tore out the heating furnace and piping and sold them. It was held, Pacific Exploitation Co. v. Strickland, Washington Supreme Court, 188 Pac. 766, that as the removal of the furnace and pipes did material damage to the building, they had become a part of the real estate, and the owner of the realty could replevy them from the purchaser.

Depreciation—Return—Apportionment.

In fixing rates for electricity, gas and steam heat for the Union Light, Heat & Power Company, the North Dakota Board of Railroad Commissioners found that 3½% was sufficient to allow for depreciation on all the general property of the electric utility, 2½% for the gas utility and 4% for the steam heat utility. It considers that the property devoted to each service should not be considered as a unit in a valuation for rate making, but should be apportioned between them. An amount allowed for workmen's compensation was apportioned between the three departments. A return of 8% as the fair present value of the whole property was held reasonable.

Thermal Quality of Gas for Heating.

In denying an application for reparation because of alleged defective service in the case of the Seattle Lighting Company it appeared that the gas furnished at all times averaged the required number of heat units. Rule 17 of the Washington Public Service Commission pertaining to gas reads as follows: "All gas furnished to consumers for lighting or heating purposes shall show a monthly average total heating value of not less than 600 B. T. U. per cubic foot with a minimum which shall never fall below 550 B. T. U. per cubic foot." This standard is as high or higher than that generally employed by regulatory bodies throughout the United States.

CORRESPONDENCE

Round Ducts and Equivalent Rectangular Ducts.

EDITOR HEATING AND VENTILATING MAGAZINE:

In Allen and Walker's book entitled "Heating and Ventilation" there appears on Page 216, Table XLII (Diameter of round ducts equivalent to rectangular ducts of various dimensions). Can you give the formula used for calculating the above mentioned table?

New York. J. I. C.

REPLY BY JOHN R. ALLEN.

Taking the formula on Page 214, Article 193, from Allen and Walker's "Heating and Ventilation":

$$P = f\frac{s}{a}D\frac{v^2}{2g}. \qquad \text{Velocity} \quad v = \frac{Q}{A}$$

Hence substituting:

$$P = f\,\frac{s}{a}\,D\,\frac{\frac{(Q)^2}{a}}{2g} = \frac{fSDQ^2}{a^2 2\,g}$$

For round pipe, unit length:

$$P = \frac{f\,(2\pi r)\,DQ^2}{(\pi r^2)^2\,rg} = \frac{2fDQ^2}{\pi^2 r^5 g} \qquad \ldots\ldots\ldots\ldots (1)$$

For square pipe, unit length:

$$P = \frac{f2(b+h)DQ^2}{b^2 h^2 2g} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equating equations (1) and (2):

$$\frac{2fDQ^2}{\pi^2 r^5\ 2g} = \frac{2f(b+h)DQ^2}{b^2 h^2 2g}$$

Cancelling quantities:

$$\frac{1}{\pi^2 r^5} = \frac{b+h}{b^2 h^2}$$

Solving for r

$$r = \sqrt[5]{\frac{b^2 h^2}{\pi^2\,(b+h)}}$$

Therefore, since $d = 2r$

$$d = \sqrt[5]{\frac{32\ b^2 h^2}{\pi^2\,(b+h)}} = 1.265\ \sqrt[5]{\frac{32\ b^2 h^2}{\pi^2\,(b+h)}} \quad \ldots (3)$$

Where d = diameter of the pipe.
b = width of the duct.
h = height of the duct.

Equation (3) is the equation used in making the table.

NATIONAL TRADE EXTENSION BUREAU

T. E. B. Field Men to Call on Heating and Plumbing Contractors.

An interesting development in the work of the National Trade Extension Bureau will be the appearance of T. E. B. road men who will personally visit the heating and plumbing contractors throughout the country. These field men will first be chosen from among the men available who have the necessary knowledge of the heating and plumbing trades in a general way. They will be thoroughly posted upon T. E. B. methods of estimating, contracting, selling and accounting and will travel constantly over the territory assigned them, bring to the local contractors the knowledge of T. E. B. advantages.

By visiting the heating and plumbing contractors from time to time, these field men will be able to give the contractor the exact detailed methods of sound business management. This exactness of mutual understanding is, of course, frequently impossible at long range.

It will be the duty of the T. E. B. field men to meet with, and visit the meetings of, local associations of contractors. At these meetings they will give talks on various phases of T. E. B. methods and work, with the idea of bringing out a general and detailed discussion of the various points made. It will also be their duty to collect and send in to headquarters detailed information of any new ideas or methods that they find working practically and sucecssfully.

These T. E. B. field men will be put out on the road, covering various territories, just as fast as the proper men can be found and employed. If our readers know of any man or men who would satisfactorily fulfill the conditions and needs of this employment with the National Trade Extension Bureau, they will be doing service to the trade at large by seeing that they are put in mutual touch.

For the present, the field men will be required to cover from three to five States, but this territory will gradually diminish as more men are added to the field force. All applications must be accompanied with the following information:

1. Give the names of at least seven contractors located in different cities to whom the Bureau can refer as to the ability of the applicant.
2. Give the names of at least three supply houses who are intimately acquainted with the applicant.
3. State the number of years associated with the heating and plumbing business.
4. State the nature of such affiliation.
5. State experience in making public talks.
6. State experience in accounting.
7. State experience in selling.
8. State age.
9. Married or single.
10. Home address.
11. Salary desired.
12. Present occupation.

Annual Convention of National Association of Master Plumbers.

A number of actions of interest to the heating trade were taken at the recent annual convention of the National Association of Master Plumbers, in Pittsburgh, Pa., June 15-17. In connection with a raise in its membership dues, the National Trade Extension Bureau will benefit to the extent of some $10,000 a year, as it is provided that one-fifth of the per capita tax shall go to the bureau.

The convention went on record, following a two-hour debate, as endorsing the open-shop principle.

On the subject of insurance involving the advisability of forming a national mutual liability insurance company for the benefit of master plumbers, the report of the committee, which had this matter in charge, was that it was impractical in view of the trouble and expense and that the same results could be accomplished in other ways. It was considered feasible, for instance, for the association to arrange with a mutual insurance company, such as the Mutual Insurance Company, of New York, to cover the contractor in the manner desired. The report was received and the convention gave the insurance company its endorsement, although the vote did not carry with it any compulsion on the part of the members or associations.

An interesting talk on business conditions was given by C. V. Kellogg, chairman of the Bureau of Standardization, who said, among other things:

"It is difficult to predict the future, but this is my own opinion, based on facts that I have been able to gather. Some have stated that the manufacturers are profiteering, but I don't believe it. The trouble is with labor. The passage of the Adamson law was a destructive move and is the greatest act recorded in this country to stifle production and increase prices. In 1914 coal was $1.00 a ton; now it is $6.00. Ore was $3.75 a ton and it is now $5.50. Coke was $1.75 and is now from $7.00 to $17.00. Pig iron has jumped since 1914 from 16.00 a ton to $43.50, while wage increases have gone up 250% to 300%.

"Prices have about reached the peak, but freights will soon increase from 30% to 50%. A prominent railroad official tells me that even if matters go along satisfactorily, the railroads will not be in shape to take proper care of transportation until October, 1921.

"There will continue to be difficulty in obtaining materials this year because production is below the demand. There is consequently a falling off of business. The trade must do business on a conservative basis but should not hold off buying as the market will not come down this year."

Mr. Kellogg recommended that orders be placed immediately regardless of prices. In view of the uncertain conditions, long-time contracts should be made in such a way as to secure full protection.

The new officers of the National Association of Master Plumbers are: President, D. F. Durkin, Jr., Philadelphia; vice-president, Joesph W. Cannon, Chicago; treasurer, R. J. Welch, Lowell, Mass.; secretary, George F. Uber, Philadelphia. It was voted to hold the next annual convention in New Orleans.

Humidity and Fresh Air.

In an address on "Humidity" before the National Warm Air Heating and Ventilating Association, at its recent convention in Cleveland, Harry P. Gale, of Oneida, N.Y., had some interesting things to say on such points as night air and inadequate water pans.

"The one and only benefit," he declared, that comes by having open windows at night is the high average humidity, which soothes the tired nerves, envelops the body in air fit to live in, and deposits the dust on the floors instead of leaving it to float to be breathed. Remember, however, that the more fresh air at night, the more water during the day to make the house clean and wholesome.

"In 1820 books called a good heat for a house 50° to 55° F.; in 1850 it was said to be quite comfortable at 62° F.; in 1890 at least 72° F. was needed, and now 78° F. is quite common. These increase in temperature mark clearly the passing from Fireplaces to Stoves to Furnaces to Steam."

INADEQUATE WATER PANS

On the subject of water-pans in warm-air furnaces, Mr. Gale said that out of 36 heaters examined, 26 showed some form of a humidifier, and only three had the pot so placed that any appreciable amount of water could be added to the air passing. In cold weather, he added, the air must be displaced from three to four times per hour in order to get the proper B.T.U. displaced, and from the amount of outside cold air taken in, it will have about 20% relative humidity. It is this dry-kiln effect that destroys furniture, makes the chairs creak and causes the mucous membrane to swell in the attempt to moisten the air for the lungs.

HEATER MANUFACTURERS NEED TO BE CONVERTED.

"One of the largest builders of central New York," said Mr. Gale, "has said to me many times that if I could convert the heater maker so that they would make a heater that would keep the air at a proper humidity (so that the woodwork would not shrink), nine-tenths of their kicks would cease when they build a house of value. Dry air is always dusty air. Dusty air is always an irritant. I have repeatedly changed a room of 25% relative humidity

and a dust count of 225,000 to 30,000 count by simply changing the humidity to 50%. Take any bedchamber at 20% relative humidity and look at the dust betrayed by a sunbeam when you dress: old skin, wood fibre, lint from cotton, linen, feathers. All of these we breathe, but they are quickly deposited if the room has a humidity of 50%. The floors and furniture are a better place for these than the lungs. You will 'wolf' about your city water, but pass this question of dust that is your particular responsibility.

HEALTHY, HUMID HEAT.

"Can you imagine a case of nerves on a June morning? The air from a register at 50% relative humidity feels very much like balmy June, but air at 20% relative humidity burns the skin, as it sucks the water from you as from a sponge. Blood-pressure is always higher with a low humidity, and low with a high humidity. I wish to make one statement now—I want it to sink in; penetrate—*that no house has healthy air if frost does not form on the windows on a cold or windy day.* This is proper mark of *humidity.* It also is the *sterling* mark of your trade, well done. *Healthy, humid heat.* Advertise it; preach it; but above all, make it."

What Is the Immediate Construction Outlook?

There are a great many factors affecting the immediate outlook for construction—rents, commodity prices, crop conditions, finance, the coming Presidential election, all of which must be studied for their bearing on the outlook for any particular type of construction. Rents may have to go higher before a normal program of new construction of many kinds can be profitably undertaken at present costs; commodity prices must be stabilized before normal industrial expansion can be realized; adequate crop returns are the basic indicators of adequate finance which governs all industry; and, while we hope there will be no disturbing economic questions, such as the tariff, raised in the coming election, yet in these days of government control and legislative regulation, the selection of a President and a national program will have much to do with the plans of all industry, including construction.

These are factors which no one can accurately forecast and to which each contractor must give the weight which, in the light of local conditions, he feels they deserve. No analysis of the future of construction, even for the coming six months, however, can be made without taking them into consideration.

There are, nevertheless, three major factors which profoundly affect the outlook for construction, and which can be met by united effort and counsel. In order that any program of construction may be developed for the coming six months, we must first devise ways and means to adjust transportation conditions, establish sound price levels for construction materials, and secure from labor its full efficiency. In direct proportion to the extent to which these questions are settled, will construction of all kinds proceed.

CURTAIL TRANSPORTATION OF LUXURIES.

Ultimately, the transportation problem is largely one of rates and control. With adequate rates assured at the earliest possible date, the equipment and facilities of the roads can be maintained in relation to the demands being made upon it; and wages commensurate with the service rendered can be paid. It will take time, however, to repair present equipment, build new rolling stock and increase facilities. Meanwhile, we shall have to adopt some plan of sharing present facilities with other industries in proportion to the need for our products. Since rates cannot be shifted like prices, according to supply and demand, some other means must be adopted in apportioning transportation facilities. This means the re-establishment of priorities sooner or later in some form or other. Already this has been started. From present indications, if construction is not to be practically suspended in some sections of the country, constructive materials must be given the right of way over less essential commodities, second only to food and fuel. With inadequate facilities at hand, only by curbing the distribution of luxuries which have jammed our freight houses and made use of cars which should have gone to more essential needs can the present situation be handled and construction proceed.

GIVE COSTS AND PROFITS PUBLICITY.

Sound price levels are fundamentally a matter of publicity; for, with confidence in the *justice* of present prices restored which would follow full publicity of costs and profits, fear that a slump may be just around the corner will be removed. Then normal buying will be restored by the knowledge that lower prices can only be had as a result of slowly deflating the world's currency and slowly increasing the world's production, processes which will require time to accomplish. Without such knowledge, investors will hesitate to build and banks will hesitate to finance new projects.

GIVE LABOR INCENTIVES TO PRODUCE.

To increase the efficiency of labor is mainly to create a new ideal in industry —the ideal of increased production. But such an ideal is of little value without an incentive behind it. During the war patriotism and spirit of teamwork for a common aim supplied that incentive. If workmen continue to demand increases in wages, shorter hours and decreased production, they may automatically create such an incentive in the competition among themselves for jobs, because of a slowing down in construction followed by idle workmen. Better, if means could be devised, to increase the efficiency of all construction labor at rates satisfactory to all.

The elimination of restrictions on output is fundamental. Moreover if some plan could be worked out by which there would be restored the mutual confidence between the contractor and the employee and by means of which it would be impressed on both that their interests were identical and that in the long run decreased production costs the workman as much as it does the employer, then a long step in the right direction will have been taken.

AN UNPRECEDENTED NEED FOR CONSTRUCTION.

In spite of these things, however, and underlying them all, there is one outstanding feature in the present outlook for construction: This is the unprecedented need for home, new highways, railroad improvements, and public works of all kinds which were postponed on account of the war, and which are today only subordinate to the nation's need for food and fuel.

The proportion of these which will be undertaken during the coming six months will depend upon the extent to which we solve the three major problems outlined above. When they have been satisfactorily dealt with, nothing short of a calamity can stop construction for long.—W. A. Rogers, President Associated General Contractors of America in the Association's *Bulletin.*

Tax Exemption to Encourage Building.

In discussing the elimination of taxes from new buildings for a term of years, as well as tax exemption on new houses during a limited period of years, as a solution of the present housing situation, W. R. B. Willcox, a Seattle architect, contributes a thoughtful article to *The Architect and Engineer.*

He quotes, among other things, a statement of the savings bank section of the American Bankers' Association to the effect that "any person sufficiently informed to advise of tax policies must appreciate the evident fact that any extension of public subsidy through tax emption can lead to no other end than the single tax on real estate, with the possible addition of a tax on income from personal service."

In his conclusion, however, he states:

"The deplorable housing situation is a challenge to civilization. If temporary exemption from taxation for houses, detached or otherwise, duplexes, apartment houses, or anything else, promises relief, no time should be lost in determining the immediate, likewise the eventual consequences of its adoption. If the prognostication of the American Bankers' Association is correct, it is time we summoned courage enough to say 'Boo!' to the hobgoblin which the words 'single tax' have conjured, get hold of the creature, dissect it, and see if there is really form and substance to it. Certainly we cannot afford to let it 'shoo' us away from any avenue of escape from an intolerable condition until its true nature is disclosed. Then we shall better know how to handle it."

The A. S. M. E. Boiler Code.

Those concerned with steam boilers are reminded by the American Society of Mechanical Engineers that the society provides a service of interest through the work of its standing committee "to formulate standard specifications for the construction of steam boilers and other pressure vessels and for their care in service." The report of this committee, known universally as the A.S.M.E. Boiler Code, gives rules for the construction and care of (1) New Installations (a) power boilers, (b) heating boilers; and (2) Existing Installations.

Interpretations of the rules are issued periodically in the monthly journal of the society and the code and interpretations together furnish a service covering the latest accepted methods of design and construction of steam boilers. The boiler code is sold at $1.00 a copy and may be had direct from the society or through the book department of THE HEATING AND VENTILATING MAGAZINE.

Michigan Law Governing Installation of Warm-Air Furnaces.

Wide interest, especially among heating men in Michigan, has been aroused by the law recently enacted in that State governing the installation of warm-air heating systems. The law refers specifically to warm-air heating plants, consisting of one or more furnaces enclosed in galvanized sheet-iron, and does not include the pipeless furnace or one-register furnace.

Before proceeding with the installation of such plant, a permit therefor must be obtained from the Department of Building Inspection, the fee being $1.00. Immediately following the completion of the installation, the Department of Inspection must be notified. The department will then inspect the work and unless complaint of violation is made within ten days, the installation will be deemed approved.

It is provided that "no warm-air heating plant shall be installed in any building for occupancy or residential purposes, unless the said warm-air heating plant shall have free space of at least 15% greater than the cross-sectional area of all warm-air pipes taken from the bonnet of the casing, and shall be of such guaranteed capacity and construction as to provide for the maintenance of 70° F. in parlors, libraries, main halls, living rooms, dining rooms and bath rooms, and a temperature of 65° F. in sleeping apartments and kitchens, and the said internal temperatures shall be possible of maintenance while the outdoor air is at zero F., without raising the inflowing air at or issuing from the registers to temperatures higher than 160° F.: Provided, however, that nothing in this section shall be construed as to interfere with the right of an owner or his agent from entering into a written agreement for any other specific temperature he may desire."

All warm-air heating plants must be set on brick, cement or other non-combustible foundation, and all metal for furnace casings must not be lighter than 26-gauge galvanized iron and must be provided with a lining of asbestos and black iron or corrugated tin.

All stacks or wall pipes to the second or third story must be equal in cross-sectional area to at least two-thirds of the cross-sectional area of the round basement pipes. First-floor register boxes must be double, or lined between the box and the floor with tin and asbestos, and at the point of greatest restriction must be equal in cross-sectional area to that of the round basement pipes. All warm-air wall registers must have a free area at least 10% greater in extent than the cross-sectional area of the round basement pipes.

Either inside or outside cold-air supply is permitted, but such supply must not be from any basement cellar or furnace room. Either galvanized iron, brick or tile boxes, with dust-tight joints, may be used for the cold-air supply pipe.

Basement leaders of 12 in. diameter or less must be of I. C. or heavier bright tin: and those over 12 in., of I. X. brght tin or galvanized iron, and of at least 28 gauge. They must have an elevation of at least 1 in. to the foot. The horizontal runs of such leaders must be not less than 2 ft. between the casing collar and the register box or wall pipes, except in stores, churches and buildings of one room, when a register face, fitted with a border, can be used. Where the leaders pass through partitions or walls, it is specified that they must have metal thimbles of 1 in. more diameter than that of the pipe when the partitions are of brick, tile or cement. If of wood, the thimbles must be of the safety or ventilated type, of 1 in. larger diameter than the pipe.

For smoke pipes 24-gauge iron is specified, with safety thimbles 2 in. larger than the pipe itself when passed through wooden walls. In addition, there must be guides or braces arranged to maintain an open space of 1 in. entirely surrounding the smoke pipe. The space between any smoke pipe and exposed wood or plastered wooden walls must be 8 in. or more. Sheilds or sheet metal protection, with lining of asbestos sheeting, must be used on all exposed wood or wood covered with plaster which is within 12 in. of the smoke pipe.

In the setting of the heater the location must be as near the center of the building as possible, with an air space of at least 18 in. between the top of the heater and the ceiling joist above it, and not less than 6 in. between the top of any metal casing and the ceiling or joist, unless the ceiling is non-combustible.

Violations of the law entail fines up to $50.00 and possible imprisonment.

Tests of cooking and heating devices of all kinds are being made by the Pittsburgh station of the Bureau of Mines, Department of the Interior, in behalf of the United States Army. While these tests are to constitute a comprehensive survey of the fuels and fuel appliances for general army requirements, the results, which will eventually be made public, will be of value to all householders.

Returning Radiator Condensation Directly to the Boiler.

Building superintendents and heating engineers will be interested in a new piping layout for a heating system, designed by the Farnsworth Co., Conshohocken, Pa., which provides for a closed-loop circuit, whereby the water of condensation from the radiators is returned directly to the boiler. This arrangement is designed to keep the radiators free of air and water of condensation from the rasystem to work on any pressure.

The method is made possible through the use of the Duplex boiler feeder which is designed to permit a continuous flow of condensation into the boiler. The condensation is held under pressure and delivered into the boiler at a temperature but little below that of the steam. The use of a receiving tank, it will be noted, is eliminated. Also there are no vents to the atmosphere, reducing the heat loss.

When the high-pressure steam from the boiler is carried to the top of the building, the steam passes through a reducing valve and then the risers drop from the main line to supply the various colis. The hangers supporting the coils are arranged to give free expansion and contraction of the riser from the coil.

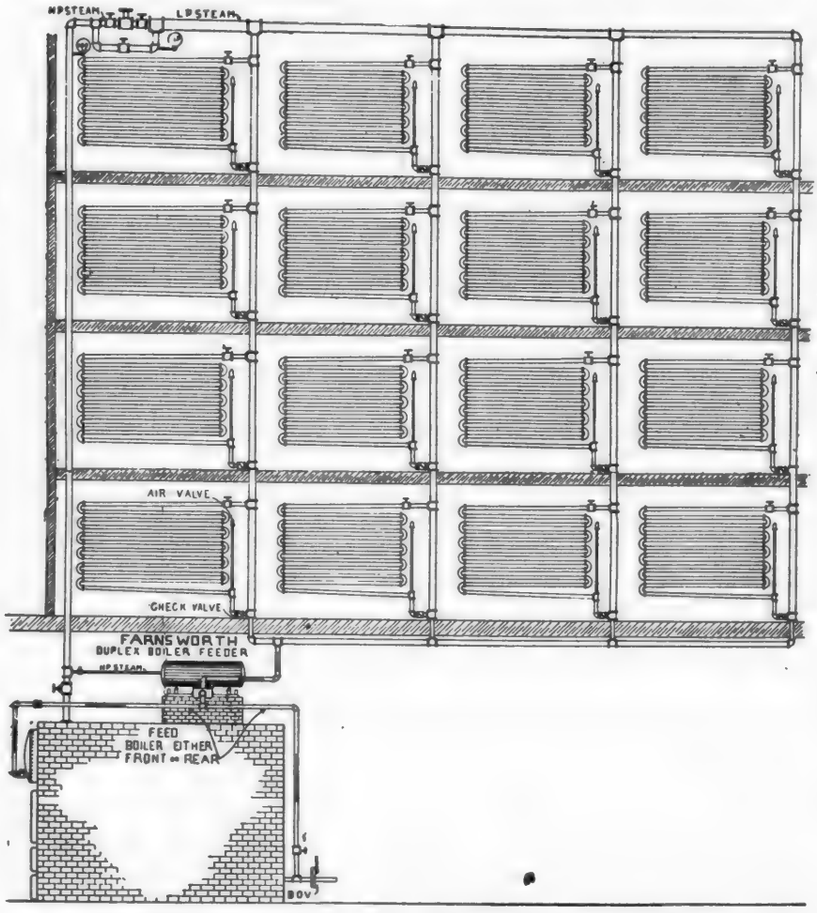
The return line of the coil is carried back into the riser with a drop of 9 in. before entering the riser and with a check valve at that point. By this static head of 9 in., all water between the check valve and the lowest pipe of the coil is sufficient to lift the check valve and permit the condensation to the coil to flow back into the same steam riser. A full-size pipe is carried from the return pipe of the coil to somewhere near the top of the coil where an automatic air valve is inserted. This full-size pipe provides a sort of air chamber and eliminates the possbility of any water squirting out of the air valve.

In this layout, the proper distribution of steam supply pipes to the coils and the proper sizes of risers must be used. In other words, it is advisable to use about the same proportions in piping these coils as would be used on the common one-pipe radiator or system.

PROVIDING FOR CONTINUOUS FLOW OF CONDENSATION TO BOILER.

The return pipe from all of the

risers is carried to a Farnsworth Duplex boiler feeder which is located somewhere above the water-line of the boilers. This boiler feeder has two chambers; one chamber is always equalized with th return line receiving the condensation, while the opposite chamber is equalized with the boiler, delivering the water into the boiler. These chambers alternately fill and empty, which provides a continuous flow of water from the heating system directly into the boiler.



NEW PIPING LAYOUT FOR RETURNING CONDENSATION DIRECTLY TO THE BOILER.

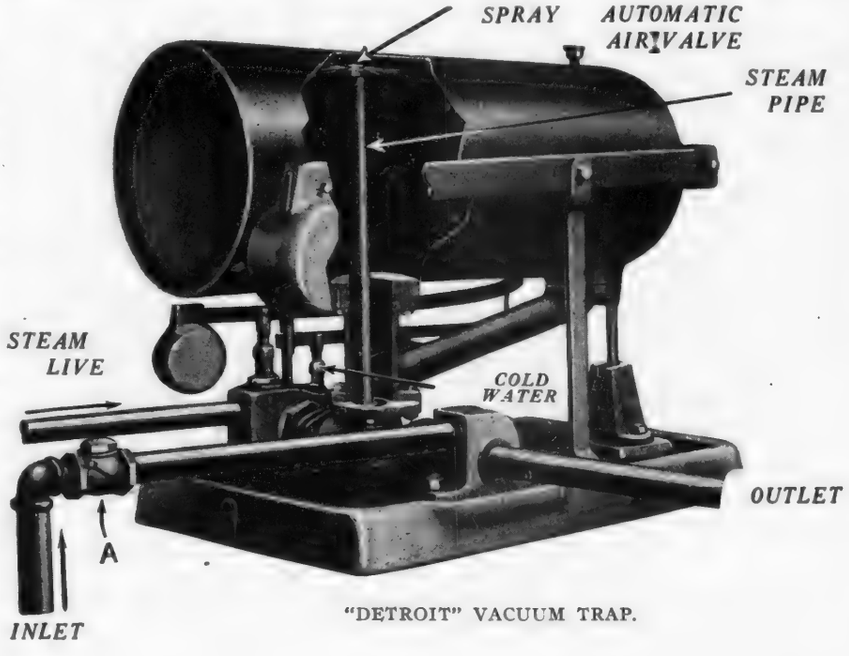
Among the advantages mentioned for this type of system is that less piping is required because no return lines are necessary other than to connect the risers to the boiler feeder. The boiler feeder will feed the condensation into the boiler at the same temperature that it leaves the system. In other words, the condensation is held under pressure and fed directly into the boiler. For illustration, if 1 lb. pressure is carried on the system, the water would be fed into the boiler at 212°; if 5 lbs. were carried, the water temperature would be about 225°, and so on.

The manufacturers state that this coil system is in use for heating purposes in some of the largest factories in the country. The condensation may be fed into the front or rear of the boiler, or in both ways. There is an advantage, it is stated, in feeding the water into the boiler both ways, because if just a little water is going in through the blow-off connection, it prevents the possibility of the blow-off connection closing up with sediment. In this connection, it is often the practice to carry a small feed line into the blow-off, so that a small portion of the water goes into the blow-off connections, serving to keep the blow-off lines free. In fact, many large plants are feeding all of the water into the boilers through the blow-off connections, in the belief that this is the best place to feed water into a boiler, especially when the water is fed very slowly and easily, as in the Farnsworth closed-loop boiler-feeding system.

Trade Literature.

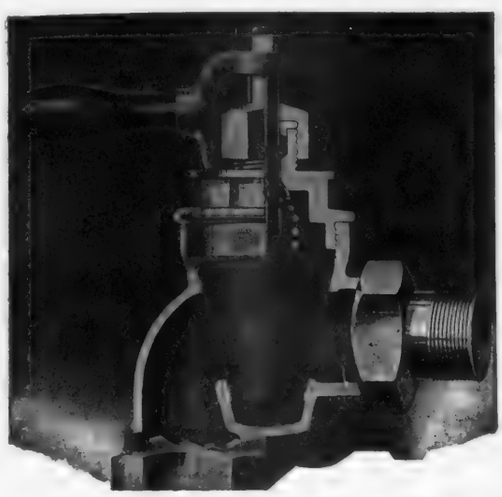
MAKE IT PAY ITS WAY is the title given by the Fisher Governor Co., Marshalltown, Ia., to its newly-issued circular on the Fisher steam trap. Sluggish condensation means a steam loss, states the circular, and a steam loss means an extra charge for fuel, labor, water, plant operation, overhead, time and less production. The important features of the Fisher steam trap are indicated in a large sectional view of the trap with details of the important parts. A price list and capacity table accompanies the circular.

"A. B. C. DETROIT" SYSTEMS FOR HANDLING CONDENSATION, which are the subject of a well-compiled catalogue published by the American Blower Co., Detroit, Mich., are attracting especial interest in the East just now, due to the fact that the Plant Engineering & Equipment Co., 192 Broadway, New York, has just been appointed eastern sales agent for this system. As the table of contents of the catalogue indicates, the system is adaptable for vacuum lines, lifting systems, pumping systems, open-end return systems, and low-pressure vacuum heating work. The line also covers "A. B. C. Detroit" separator traps and receivers. Ten points of exceptional value credited to "A. B. C. Detroit" systems are that they increase the heating circulation, heating surface, engine horse-power, boiler horse-power and heater capacity, while they decrease the coal bill, water bill, initial cost, yearly maintenance and general troubles. Size 8½ x 11 in. Pp. 48.



"DETROIT" VACUUM TRAP.

GORTON QUARTER-TURN PACKING LOCK VALVES, for all systems of steam, water, vapor and vacuum heating, are brought to the attention of the trade in a new catalogue published by the Gorton & Lidgerwood Co., New York. While special attention is given to the materials of construction used in this valve, its design is equally remarkable in the way in which it provides a free passageway. As will be noted from the accompanying illustration, this valve has a full-sized unobstructed horizontal passageway through it, allowing the water and steam to flow freely, with a minimum of friction. On this account it is possible to use a valve one size smaller for a given duty than a globe type of valve. Views are shown of a 70-sq. ft. radiator connected by a 1-in. Gorton valve on a one-pipe system, and of a 280-sq. ft. radiator connected by a 1½-in. valve, also on a one-pipe system. Special attention is called by the manufacturers to the ease with which the valve may be turned on or off, which may be done by a touch of the foot. The unique construction of the plug is familiar to our readers and the company states that actual use over an extended period shows no deterioration in the material itself or in its efficiency. This is accounted for by the fact that the plug is of a mineral composition and not metal. It has also been found not to soften under high steam temperatures. The disc, it is explained, is moulded and then put on a special grinding machine and the surface ground smooth and to an exact gauge and taper. The inside of the valve body is bored on a special machine and reamed to an exact gauge and taper, so that the disc fits in the valve body without lapping or grinding. The catalogue gives the necessary data regarding each type made, including the quarter-turn modulating and plain types, the straightway type, and the straightway type with union. Size 4¼ x 7 in. Pp. 31.



SECTIONAL VIEW OF GORTON QUARTER-TURN PACKING LOCK RADIATOR VALVE.

DUNHAM HAND BOOK, covering the Dunham heating specialties made by the C. A. Dunham Co., Chicago, Ill., and equally remarkable for the unusual amount of general heating data it contains, is the title of a new publication issued by that company. First place is given to the Dunham radiator trap, the illustrations showing a variety of radiator connections, with pipes below ceiling, above floor, between floor and ceiling, etc. Illustrations of the other Dunham specialities are also accompanied by numerous installation details. Upwards of 60 pages are given over to the data which are presented in a concise form that will be fully appreciated by the engineers and contractors. Sixe 3¾ x 6¾ in. pp. 144.

PACIFIC STEEL HEATING BOILERS which, during the past seven years, have been built and sold exclusively on the Pacific Coast, are now offered to the trade in the central and eastern fields through the fact that the manufacturer, General Boilers Company, has recently completed the first unit of a plant in Waukegan, Ill., where the boilers are now being manufactured in quantity. In recently-issued circulars describing these boilers, the fact is mentioned that they are made in straight-draft and down-draft styles, for both steam and water heating. They are of the double-return tubular type. They burn soft coal, wood or crude oil, but will burn any other fuel equally well. In the smokeless type, which has a down-draft grate, use is made of the Eureka arch in the fire-box. This arch has hollow passages for admitting the mixture of gas and air to the combustion

PACIFIC STEEL SMOKELESS HEATING BOILER.

chamber beyond the arch. Among the points mentioned in favor of Pacific boilers are their detachable shell, which is connected to the fire-box with machine-faced open-hearth steel flanges; their smoke outlet at the rear end of shell, horizontal and requiring no extra head room; their cleaning features, the cleaning of tubes being all from the front through full-width flue doors; their arch which is supported on a water-circulating tube; and their electrically-welded seams, making them practically one continuous sheet of steel, unaffected by expansion and contraction. The catalogues give full specifications for both steam and water types of each boiler, covering no less than 23 sizes of each series. Size of catalogues 9½ x 6 in. Pp. 3 and 8, respectively.

BUNDY OIL SEPARATOR is featured in a catalogue (Bulletin No. 1130) received from the Griscom-Russell Co., New York, the company stating that in spite of the years which have elapsed since this apparatus was designed, it has continued to hold its own as a leader in its line. In the construction of this separator the shell and baffle plates are of cast-iron. These multiple baffle plates are of special staggered grid construction and are designed to insure the removal of all oil from the exhaust steam before it leaves the separator. The oil, after being deposited on the

BUNDY OIL SEPARATOR.

saw-tooth grids, enters a duct inside of the grid bars and flows through this duct, to the large receiver reservoir at the bottom. This feature prevents steam from picking up the oil again after it has been deposited on the baffle plate. The baffle plates in the Bundy separator are removable through an opening provided and may be taken out and cleaned in a lye solution. In this way, it is stated, the separator fulfils one of the most important requirements of an efficient oil separator in being easy to clean. Size 6 x 9 in. Pp. 12 (punched for binding).

SIROCCO SERVICE for July, 1920, the periodical of the American Blower Co., Detroit, Mich., shows interesting views of "The Million-Dollar Theatre" in Los Angeles, Cal., known as Grauman's Theatre, which is equipped with an "A. B. C." ventilating system. Another article describes the Hartmann balanced duplex system of ship ventilation installed on "the goode shyppe St. Paul," (illustrated in THE HEATING AND VENTILATING MAGAZINE for June, 1920).

Typical Form of Cost-Plus-Fixed-Fee Contract.

A typical form of "Cost-Plus-Fixed-Fee" contract, used by the Wells Bros. Construction Co., of Chicago, is shown herewith:

This agreement made this.....day of .....19....., between.....a domestic corporation hereinafter called the Owner, party of the first part, and Wells Brothers Construction Co., a domestic corporation, hereinafter called the Contractor, party of the second part,

Witnesseth, That whereas, the Owner desires to erect..... ....in the City of..... as hereinafter described, and in consideration of the mutual promises herein contained and of One Dollar ($1.00) by each party to the other in hand paid, the receipt whereof is acknowledged, it is agreed as follows:

PLANS AND SPECIFICATIONS WHEN COMPLETED BECOME A PART OF THIS COTRACT.

Art. 1. The Contractor agrees to provide all the labor and material and to do all things necessary for the proper construction and completion of the

in conformity with the plans and specifications prepared and to be prepared by ..... Architect, said plans and specifications to be identified by the signature of the parties hereto and made part of this contract. If anything in the specifications is inconsistent with this agreement, the agreement shall govern.

OWNER AND ARCHITECT MUST BE SATISFIED.

Art. 2. It is agreed that the work included in this contract is to be done under the direction of the said architect and to the entire satisfaction of the said owner and architect, and that the decision of the architect as to the true construction and meaning of the said plans and specifications shall be final and binding upon both parties hereto.

A MINIMUM OF SUBCONTRACTS STATED IN A PERCENTAGE OF TOTAL.

Art. 3. It is agreed that the contractor will himself execute the main part of the work, namely, excavation, plain and reinforced concrete work, masonry, waterproofing, tile partitions, and rough and finished carpentry, and that no profit on the actual cost of material and labor entering into these branches shall go to any subcontractor. The work to be executed by this contractor amounts roughly to sixty per cent (60%) of the cost of the completed buildings.

OWNER AND ARCHITECT APPROVE ALL BIDS BEFORE LETTING OF SUBCONTRACTS OR ORDERING OF MATERIALS.

Art. 4. After the approval of the plans and specifications by the owner, the contractor shall obtain bids for material, for labor and subcontracts from such responsible parties as are willing to make bids, and shall submit said bids to the owner and architect and shall co-operate in securing good competition and the best prices obtainable for labor, material and subcontracts thereon. All contracts for material and labor and all subcontracts shall be subject to the approval of the owner and architect and copies thereof filed with the owner and architect.

BUILDER ASSUMES FULL RESPONSIBILITY AS CONSTRUCTION MANAGER FOR THE OWNER.

Art. 5. The contractor recognizes the relations of trust and confidence established between him and the Owner by this contract. He covenants with the owner to furnish his best skill and judgment and to co-operate with the architect in forwarding the interests of the owner. He agrees to furnish efficient business administration and superintendence and to use every effort to keep upon the work at all times an adequate supply of workmen and materials, and to secure its execution in the best and soundest way and in the most expeditious and economical manner consistent with the interests of the owner.

Art. 6. The contractor shall keep accurate and detailed books of account in the construction office at the building, open to the inspection of the owner and architect at all times. The contractor will allow the owner the benefit of any and all discounts taken or received and shall at all times act in good faith and to the best advantage of the owner in the purchase of materials, in the employment of labor and in all its conduct and activities relative thereto.

FIXED FEE PAYABLE IN INSTALLMENTS DURING PROGRESS OF THE WORK.

Art. 7. In consideration of the performance by said contractor of all the covenants and conditions herein contained, the owner agrees to pay to the contractor the sum of..... ....Dollars ($.....) in addition to the actual net cost of the buildings as herein defined. Said sum of ..... Dollars ($.....)to be paid as follows: .... Dollars ($.....) on the first of each month, commencing the.....day of.....19..

NET COST DEFINED CLEARLY TO AVOID POSSIBLE MISUNDERSTANDINGS.

Art. 8. (a) By actual net cost set forth herein is meant all sums which the contractor shall expend in the erection and completion of the buildings as called for by the plans, excepting office expenses, rent, salaries, light and other office charges of the contractor at its main office in Chicago. The contractor will not include in the cost of the buildings the salary of the executive officers of the corporation, or the Accounting and Contract Department at its main office in Chicago, but the salary of its resident superintendent, auditor, foreman, clerks, etc., who may be

located at the building on this contract, shall be included in the cost of the buildings.

(b) As part of the net cost of the building the contractor will include the actual cost to the contractor in the preparation, inspection, delivery and removal of materials, tools and equipment; all expenditures for superintendence and payrolls, all expenditures for transportation and traveling expense of the officers and employees of the company for expediting the work under contract; the cost of equipment and expense of temporary office at the building; the cost of liability and compensation insurance. The plant and equipment required for the work shall be included in the cost of the building on a monthly rental and made a part of this agreement. basis, as per schedule hereto attached All perishable tools, materials and supplies delivered to the building by the contractor for temporary purposes shall be charged to the cost of the work not exceeding standard market prices, subject to the approval of the owner or his authorized agent. The lumber furnished shall be charged as part of the cost of the work at its cost to the contractor. All lumber and other materials and supplies left over after completion shall be sold on the premises for the best prices obtainable after five days notice in writing by the contractor to the owner, and the proceeds will be paid to the contractor and credited as a reduction in the cost of the buildings.

90% OF SAVINGS UNDER PRELIMINARY ESTIMATE ACCRUES TO OWNER.

Art. 9. Whereas, it has been decided to erect the buildings above described, and whereas a careful and conservative estimate of the entire cost of the buildings shows that it should not exceed the sum of .....
.....Dollars ($.....) including the before mentioned fee of.....
..... Dollars ($.....)
the owner will pay the contractor ten per cent (10%) of any saving effected below the figure.

OPERATION FINANCED WITH OWNER'S FUNDS ADVANCED SEMI-MONTHLY.

Art. 10. (a) The contractor and owner especially agree that the owner will provide funds at all times in..... for the payment of all payrolls, bills for material, and local expenditures on the work included under this contract, and to provide funds for discounting all bills for materials and supplies of every kind for the benefit of the owner as far as discounts may be obtained. These payments shall be considered as advances on account of the contract and shall be credited on the semi-monthly estimates for payment. All payment by the owner to the contractor under this contract (except payments on account of the contractor's fee,) shall be deposited in a special bank account established by the contractor for this contract. All checks against this special bank account will require the counter-signature of the owner's representative.

(b) The contractor will render to the owner or the owner's authorized representative on or about the 1st and 15th of each month, a statement of the expense, payrolls, bills for materials, tools, subcontractors' estimates, vouchers, etc., for payment. This statement will constitute the contractor's application for payment and shall be checked and approved by the architect and the owner or his authorized agent whereupon the amount shown to be due by the approved statement shall be paid in current funds. Payrolls to be verified under oath if required. If vouchers be not objected to in writing within 30 days after delivery to the owner or his authorized agent, the items of expenditure embraced therein shall be deemed to be approved by the owner.

BUILDER GUARANTEES OWNER AGAINST SUITS AND CLAIMS.

Art. 11. (a) The contractor shall procure for the owner and contractor and deliver to the owner, policies for workmen's compensation, public liability in $10,000 and $20,000 limits, or such higher amounts as may be desirable at the owner's option, and owner's contingent liability insurance in the London Guarantee & Accident Co., Limited, casualty and payroll insurance, and the net preiums for the same shall be charged as part of the cost of the buildings. And the said contractor hereby agrees to save and to hold harmless the said owner of, from and against all suits, claims and demands based upon any alleged injury to persons which may occur or be alleged to have occurred by or on account of any act or omission on the part of the said contractor, the subcontractors or any of their servants or agents.

(b) The owner agrees to carry fire and tornado insurance covering all materials, equipment, construction work, etc., in and around the building, protecting the parties hereto as their interests may appear. It is especially agreed that the contractor shall not be held responsible or liable for any loss, damage, detention or delay caused by fire cyclone, strikes, lockouts, civil or military authority, insurrection or riot, or other causes beyond the control of the contractor.

DEFINITE PROMISE OF DELIVERY.

Art. 12. All work in connection with said building shall be carried on with all possible speed consistent with reasonable cost, good workmanship and safety of construction and whereas, time is the essence of this contract, the contractor agrees to commence work immediately after the site for same is delivered to him by the owner. It is agreed that the erection of said buildings shall progress continuously excent for strikes, lockouts, and the acts of God, or other delays beyond the control of the contractor, with the intent that the buildings shall be ready for substantial occupancy on or before the expiration of .....months from the date that site for the building is delivered to the contractor by the owner.

"CHANGES" BRING NO ADDED PROFIT TO BUILDER.

Art. 13. The owner or architect may from time to time, by written instructions to the contractor, make changes in the drawings and specifications, issue additional instruction, require additional work or direct the omission of work previously ordered, and the provisions of this contract shall apply to all such changes, modifications and additions with the same effect as if they were embodied in the original drawings and specifications. The cost of all such changes is to merge in the final cost of the work. No changes involving additional cost shall be made in the work under this contract except upon written order of the architect or owner. The amount to be added to the estimated price under this contract on account of such changes shall be the estimated cost to the contractor for doing the work, including liability insurance, plus ten per cent (10%) for a margin of safety to protect the contractor's portion of any savings below the estimated price.

NO PROFIT ON TEMPORARY HEAT.

Art. 14. No temporary heat is included in the estimated price; should temporary heat be required in order that the work may proceed during cold weather, the architect or owner shall authorize such temporary heat, as an addition to the estimated price on the basis of actual cost to the contractor, including liability insurance, plus ten per cent (10%) for a margin of safety to protect the contractor's portion of any savings below the estimated price

It is especially agreed that the term "Temporary Heat" includes all preparation for the temporary heating of the building and for the heating of concrete and mason's materials; the furnishing of temporary heat; all salamanders, stoves, labor, attendance, liability and compensation insurance, all temporary enclosure of the buildings with canvas or otherwise, all preparation for, and all thawing of ice and snow from the forms with steam or otherwise.

OWNER MAY COMPEL EMPLOYMENT OF ADEQUATE FORCES.

Art. 15. Should the contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen, or of materials of the proper quality, or fail in any respect to prosecute the work with promptness and diligence, or fail in the performance of any of the agreements herein contained such refusal, neglect or failure, being certified by the architect, the owner shall be at liberty after five day's written notice to the contractor, to provide any such labor or materials and charge the cost thereof against the estimated price under this contract; and if the architect shall certify that such refusal, neglect or failure is sufficient ground for such action, the owner shall also be at liberty to ter-

minate the employment of the contractor and to enter upon the premises and take possession, for the purpose of completing the work included under this contract, of all materials, tools and appliances thereof, and to employ any other person or persons to finish the work and provide the materials therefor; and in case of such discontinuance of the employment of the contractor, it shall not be entitled to receive any further payment under this contract until said work shall be wholly finished, at which time, if there shall be an unpaid balance due to be paid to the contractor under this contract, the same shall be audited and certified by the Architect and be paid by the owner to the contractor. The architect shall also adjust the contractor's fee under this paragraph, on the prorate basis of work performed by the contractor.

ARBITRATION PROVIDED IN CASE OF DISPUTE.

Art. 16. Except as herein otherwise provided, it is mutually agreed that should any dispute arise under this contract, between the contractor and the owner, either during the progress of the work or after the termination thereof, or the abandonment or breach of this contract as to the quantity or quality of work done hereunder, or as to any matter of payment or amount of payment to be made hereunder, or, as to any matter of loss or allowance under this contract, then such matter in controversy shall be referred to three arbitrators; one to be chosen by each of the parties to this agreement and the third arbitrator to be chosen by the other two arbitrators so selected, before proceding to the business of arbitration; and the decision of any two of said three arbitrators shall be final and conclusive upon all parties hereto and such determination shall be a condition precedent to the right of action by either party as against the other. Each party hereto shall pay one-half of the expense of such arbitration.

In Witness Whereof, the parties to these presents have hereunto set their hands and seals, this day of .....19.....

.....

.....

RENTAL SCHEDULE OF EQUIPMENT IN ACCORDANCE WITH CONTRACT *

*Rental prices will be revised in accordance with standard market rentals at the time contrace is closed.

	Per Month
35 H. P. double drum steel hoist	$100.00
50 H. P. double drum electric hoist	100.00
1-Yd. concrete mixer with engine or motor	150.00
Tower equipment, including cathead, set of top and bottom sheaves and tower hopper	50.00
Power driven saws, gas or electric	40.00
Mortar mixers	60.00
Clamshell derrick	125.00
3-Drum engine for clamshell	125.00
10 H. P. swing engine	25.00
1½-Yd. clamshell buckets	60.00
	Per Month
Motors (Per H. P.)	$ 1.00
Engineer's transit	10.00
Engineer's level	7.50
Brick hoist, electric	75.00
Centrifugal pumps, electric (sump)	25.00
5-Ton stone jacks	5.00
Small Sasgen derricks	10.00
Small office safe	4.00
Brick cages	10.00
Edson hand pumps	3.00
Steam syphons	2.50

Death of Arthur C. Walworth.

Arthur C. Walworth, formerly president of the Walworth Construction Co., now the Walworth-English-Flett Co., heating and ventilating engineers and contractors, Boston, Mass., died at his home in Newton, June 23. He had long been ill.

Mr. Walworth was 76 years old. He came from a family that was prominently identified with the steam heating industry. His father was James Walworth, founder of the Walworth Construction Company. The son was born in Boston in 1844 and graduated from the Boston Latin School and from Yale University. He became president of his father's company in 1887 and, upon his retirement, was succeeded by his own son, Arthur C. Walworth, Jr. He was also at one time president of the Malleable Iron Fittings Co., of Branford, Conn.

Mr. Walworth was active in politics, serving in the Massachusetts legislature for two terms. He was a member of the American Society of Mechanical Engineers and a past president of the Yale Club of Boston. He was one of the early presidents of the National Association of Master Steam and Hot Water Fitters (now the Heating and Piping Contractors' National Association). He leaves a widow, four sons and two daughters.

An Advertisement.

By Dr. Frank Crane.*

The United States of America is the biggest business concern that is, or ever was, on the face of the earth.

It is composed of over a hundred million partners, among whom the average of business ability and respect for law is higher than in any other group of people in the world.

It is not well managed, because it is a nation, and no nation is managed well, on account of the traditional nonsense inherited from the days of monarchies. Some day nations may be run as business concerns; at present they are run like college fraternities or women's clubs.

But the United States is better off than any other nation. Its Government is the most secure because it is the most easily changed, and the people in it have the final saysso.

* (Copyright, 1920, by Frank Crane and Associated Newspapers).

More people have a little extra money now than ever before. They are buying many things they don't want. They are investing millions in wild-cat concerns.

If you have any money, it is the purpose of this advertisement to tell you the best possible place to invest it.

Buy the Liberty Bonds, Victory Bonds, or War Savings Stamps of the U. S. A. Some of you bought them during the war and are chagrined now to see they have fallen in market value.

Many are selling them now to spend in luxuries or to invest in private concerns.

But remember that these government securities, though their market value is less, have as much real value as ever.

All that was said during the war about their absolute security is true to-day, and always will be true.

Their market value is off a bit simply because so many foolish people are selling them.

A Wall Street correspondent says: "The security back of the Liberty Bonds has not been impaired in the slightest degree, and if held to maturity there is no question they will be redeemed at par. Buyers at present prices are assured of an exceedingly attractive interest yield. The idea underlying the issue of all the Liberty Bonds was that the people should purchase them as an investment rather than as a speculation, and as an investment they are as good to-day as they were on the day they were put out."

You can buy these bonds now to net you a yield of 6 per cent.

If you do not know just what to do with your money; if you are confused and in doubt, buy the U. S. A. securities.

Keep what you have. Do not sell. They are bound to go up.

They are the safest securities known.

Buy U. S. A. securities. Don't sell. Keep what you have. Some day you will be glad of it.

New Publications.

PROCEEDINGS OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for 1919 has been issued. It is a volume of 432 pages and covers the annual meeting of the society in January, 1919, in New York, and the mid-summer meeting, held in Pittsburgh.

Plant Engineering and Equipment Co., New York, has been appointed exclusive eastern and export agents for the American Blower Company's A. B. C. "Detroit" systems for handing condensation.

A report issued by the Federal Board for Vocational Education states that 28,074 men had entered training up to February 28, 1920. Of this number 1413 are enrolled in engineering courses, 55 being enrolled in architectural engineering, 68 in chemical engineering, 266 in merchanical engineering, 7 in industrial engineering, 163 in chemistry, 17 in oil technology and 3 in metallurgy. Heating and ventilation are not listed as a separate course.

Copyright, 1920, by American Radiator Company

Make the Basement Beautiful and Livable

Over 25% of the cost of a building goes into the basement, yet 95% of basements are damp, crude, unattractive places. Transform the basement with the

New IDEAL *Type "A" Heat Machine*

This finely finished, dust-tight, smoke-free boiler inspires new ideas in attractive, livable cellars.

The Type "A" scientific heat utilization and automatic control guarantee 30% fuel saving.

Send for illustrated catalog giving the test chart record of actual economy and service.

AMERICAN RADIATOR COMPANY

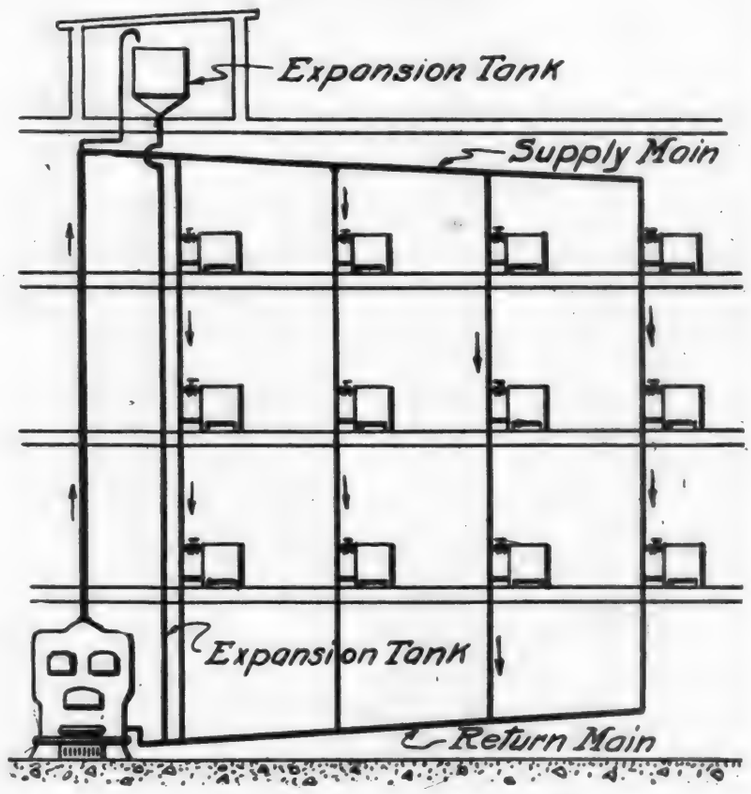
Makers of the world-famous IDEAL Boilers and AMERICAN Radiators.

Sales Branches and Show Rooms in all large cities.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY.

One-Pipe Down-Feed System.



The accompanying illustration shows a typical arrangement of a strictly one-pipe water heating system. This system may be installed in only one-way—a down-feed system with an overhead supply main and a bottom return main. The radiators are tapped top and bottom, same end, and have both supply and return tappings connected to the same drop in the manner illustrated. Theoretically the drop should be reduced in size between the radiator supply tee and the radiator return tee in order to shunt some of the flow through the radiator; this feature, however, is often neglected and the difference in the weight of the water in the radiator and the weight of the water in the riser is depended upon to cause a proper circulation in the radiator. This difference in weight is caused, of course, by the cooling and contracting of the water in the radiator as it gives off its heat.

The chief objection to the use of this system is the constant decrease of temperature of the water in the supply drop and in a building of any considerable height this reduction of temperature in the supply (due to the dumping of the radiator returns back into the same pipe) reaches such a serious amount as to make necessary an increase in the surface of the lower radiators to compensate for the cooler water which they receive.

No air valves are necessary as the entire system is vented from the high point at the top of the main supply riser from which point a small vent is run up and turned over above the expansion tank as shown.

This system of piping is probably the cheapest of any water heating system, but is not as satisfactory as the more scientifically designed two-pipe systems.

WATER HEATING, GRAVITY—One-Pipe Down-Feed System No. 133-H

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY.

Sizing Mains and Risers for One-Pipe Systems.

The sizing of the mains on a one-pipe water heating system may be carried out along the lines of equivalent pipe sizes according to valve areas (Data Sheet No. 133-G) or may be based on the height of the radiators above the boiler.

In the first place, owing to the small amount of head available between the top and bottom radiator connection, the tendency to circulate water into and out of the radiator is not great and the full size standard radiator tapping should be utilized for the runout and valve, in order to assist this circulation all that is possible. This consideration then determines the size of the radiator valve and radiator runout.

The size of the riser may be developed by taking the equivalent size from the following table, although this would best apply on small jobs. The sizes of the mains can then be developed from the risers by the same means.

TABLE I—EQUIVALENT PIPES

NOMINAL SIZES OF PIPES IN INCHES. EQUIVALENT SIZES OF PIPES IN DECIMALS.

½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8
1.00	2.27	4.88	10.00	15.8	31.7	52.9	96.9	140	205	377	620	1292
	1.00	2.05	4.30	6.97	14.0	23.3	42.5	65	90	166	273	569
		1.00	2.25	3.45	6.82	11.4	20.9	30	44	81	133	278
			1.00	1.50	2.70	5.25	9.1	12	19	32	68	110
				1.00	1.26	3.34	6.13	9	13	23	39	82
					1.00	1.67	3.06	4.5	6.5	11.9	19.6	40
						1.00	1.82	2.70	3.87	7.12	11.7	24
							1.00	1.50	2.12	3.89	6.39	13.3
								1.00	1.25	2.50	4.25	9.0
									1.00	1.84	3.02	6.3
										1.00	1.65	3.4
											1.00	2.1
												1.0

Example—Assume six risers each with three radiators; top radiator 100 sq. ft., middle radiator 70 sq. ft., bottom radiators 40 sq. ft., to determine pipe sizes of valves, radiator runouts, drops, and main at boiler.

As this is a one-pipe system all radiator runouts and valves will be full size of standard tappings or as follows:

Size of Radiator. Sq. Ft.	Std. Tapping. Inches Diam.	Size of Valve. Inches Diam.	Size of Runout Inches. Diam.
100	1½	1½	1½
70	1¼	1¼	1¼
40	1	1	1

Size of riser from Table I will be equivalent to ½ pipes for

1—1½ in. = 1 × 15.8 (½-in. pipes) = 15.8
1—1¼ in. = 1 × 10.0 (½-in. pipes) = 10.0
1—1 in. = 1 × 4.88 (½-in. pipes) = 4.88

30.68 (½-in. pipes)

30.68 (½-in. pipes) = 2 in. drop.
Six risers equal to 30.68 (½-in. pipes) each = 184.08
184.08 (½-in. pipes) = 4-in. main at boiler.

(*Concluded on Data Sheet No.* 133-J)

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY.

Sizing Mains and Risers for One-Pipe Systems.

(*Concluded from Data Sheet No.* 133-I.)

Drops and mains may also be sized by means of the use of factors, as given in the following table:

EQUIVALENT PIPE FACTORS.

Nominal Size of Pipe Inches Diam.	Factor
½	2
¾	5
1	10
1¼	20
1½	30
2	60
2½	110
3	175
3½	260
4	380
5	650
6	1050
7	1600
8	2250

Taking the same problem
1—1½ in. = 1 × 30 (factor) = 30
1—1¼ in. = 1 × 20 (factor) = 20
1—1 in. = 1 × 10 (factor) = 10
60 (factor) = 2 in. riser.
Six risers each with a factor of 60 =
6 × 60 (factor) = 360 (factor) = 4 in. main at boiler.
This checks with the sizes already found.

As a matter of fact, however, the circulation in the riser is governed by the *height* of riser, and the *temperature* of the water therein, and *not* by the *size* of the radiator runouts. Therefore, the radiators exercise no influence on the circulation in the riser excepting that they cool the water to produce the circulation. If these radiators were all situated, say, 80 ft. above the boiler, the riser could be sized from Table I on Data Sheet No. 133-G, from which it will be seen that 210 sq. ft. (total radiator surface) situated 80 ft. above the boiler level will require only a 1¼-in. riser, instead of a 2-in. as was indicated by the use of the radiator tappings. Owing to the top radiator having a 1½-in. connection the drop would probably be made 1½-in. anyway.

Now suppose the top radiator of 100 sq. ft. to be located 80 ft. above the boiler, the 70 sq. ft., as 20 ft. above the boiler and the 40 sq. ft. as 10 ft. above the boiler. In this case the circulation will be determined by the *average* temperature of the riser and this can easily be found by determining an equivalent elevation upon which all the radiation could be placed and produce the same effect.

The average distance that all the radiation is above the boiler is found by the formula

$$\frac{(a \times fa) + (b \times fb) + (c \times fc) + (d \times fd) \text{ etc.}}{a + b + c + d \text{ etc.}}$$

in which a, b, c, d, etc., are the square feet of radiator surface and fa, ba, ca, da, etc., are the respective vertical distances above the boiler in feet.

In the particular case in question

a = 100 sq. ft.	af = 80 ft.
b = 70 sq. ft.	bf = 20 ft.
c = 40 sq ft	cf = 10 ft.

Substituting

$$\frac{(100 \times 80) + (70 \times 20) + (40 \times 10)}{100 + 70 + 40} =$$

$$\frac{8000 + 1400 + 400}{210} =$$

$\frac{9800}{210}$ = 46 ft. equivalent distance of all radiation above boiler.

According to the same Table I (Data Sheet No. 133-G) this will require a 1½-in. riser.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY.

Capacity of Risers.

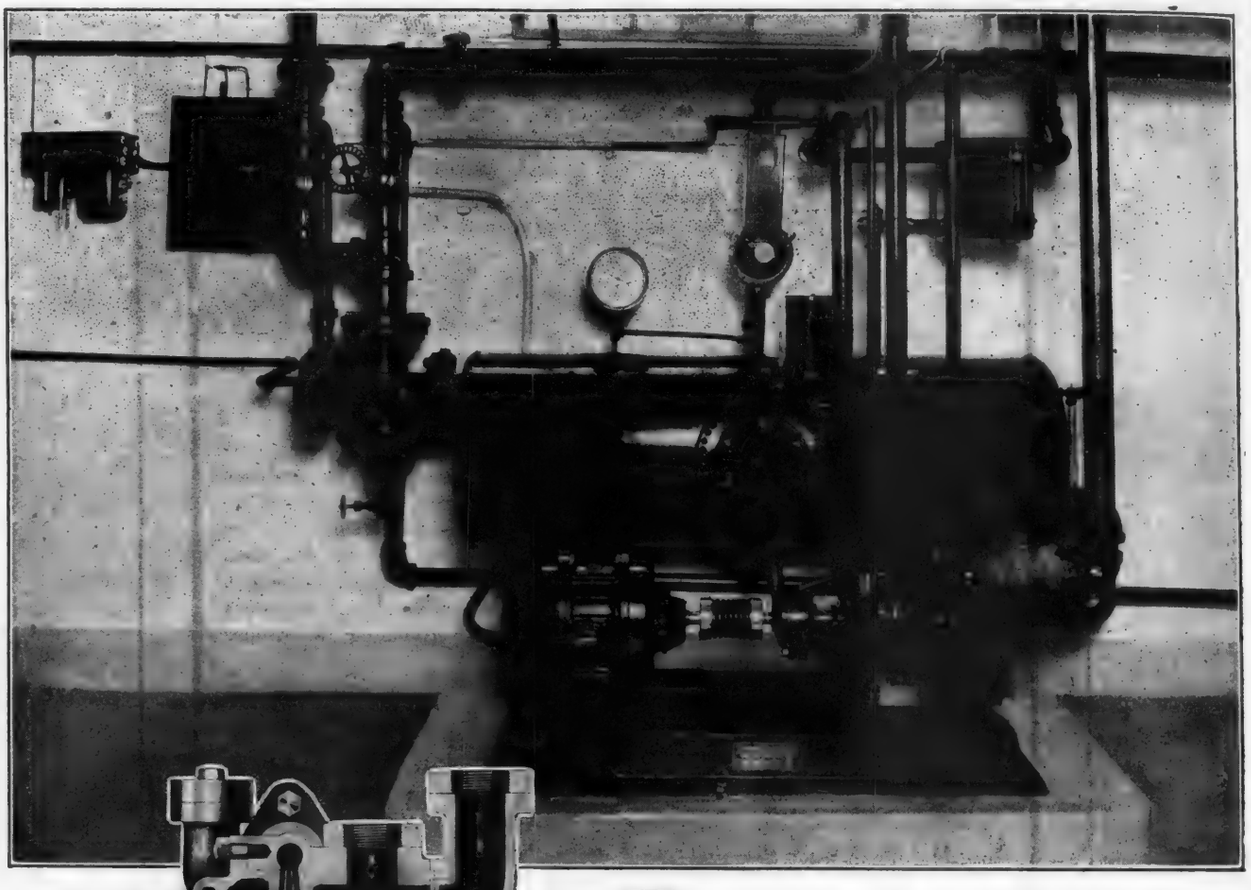
Owing to the fact that radiators are often situated at intermediate points up the riser, it is self-evident that there will be a greater tendency to circulate to the upper radiators than to the lower, owing to the increased head due to the additional height, giving a greater velocity in the high risers. Where all the radiation is located at the top of the riser, and the riser is one size all the way, the problem is comparatively simple, but where radiators are fed at each and every floor, the lower radiators must be cared for in some manner to insure their receiving the proper circulation in spite of their lower elevation.

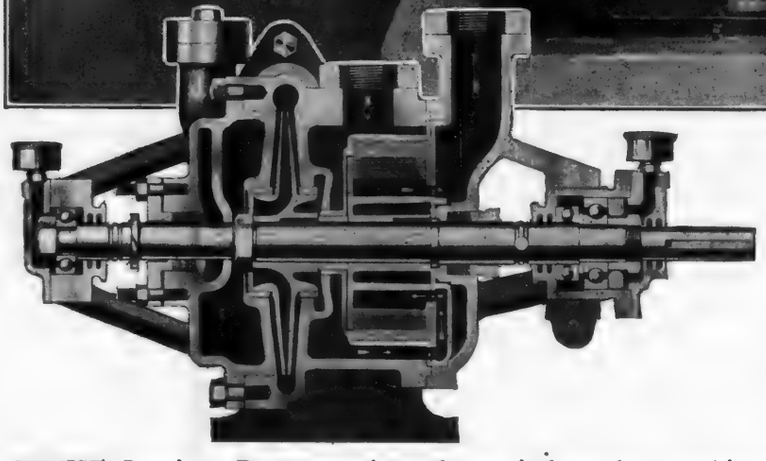
Assume six radiators of 100 sq. ft. each set one over the other on each floor of six stories, 10 ft. apart, and assume the vertical distance from top radiator to boiler to be about 65 ft. To size the supply pipe for such a condition refer to Table I (Data Sheet No. 133-G) and obtain the proper size of valve and branch supply for each radiator according to its elevation. The schedule is as follows if the factors given in Data Sheet No. 133-J are used to equate the pipe sizes:

Floor	Size, Sq. Ft.	Elevation Feet	Size of Valve, In. Diam.	Factor	Sum of Factors	Size of Riser, In. Diam.
Sixth	100	65	¾	5	5	¾
Fifth	100	55	1	10	15	1¼
Fourth	100	45	1	10	25	1½
Third	100	35	1	10	35	2
Second	100	25	1¼	20	55	2
First	100	15	1¼	20	75	2½
Base Boiler	0	none	—	—	—	—

This allows each radiator to be treated as a separate proposition and to be handled entirely on the basis of its size and elevation above the boiler, this treatment being carried back through the riser and the mains by means of the pipe equations used to size the risers and mains.

EFFICIENT HEATING demands the JENNINGS PUMP





Size "D" Unit, Automatic Operation

C. R. & M. BOAT LINE

Terminal Bldg. Milwaukee, Wis.

Capacity 40,000 sq. ft. direct radiation. This pump has an air capacity of twenty-five cubic feet per minute, in addition to a water capacity of sixty gallons per minute.

The motor is only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse-power is over fifty per cent.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 8 gives them in detail. Write for it.

NASH ENGINEERING COMPANY

SO. NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

National Association of Master Plumbers will have its headquarters at 108 South Twentieth Street, Philadelphia, according to an announcement by President D. F. Durkin, Jr., who is a Philadelphian. The headquarters will be in charge of John Whitaker, executive clerk.

June Building Operations, according to statistics compiled by the F. W. Dodge Company, show an increase of 6% over the previous month. The contracts awarded during this month in the territory east of the Missouri and north of the Ohio Rivers, amounted to $260,834,000. A great increase in the volume of industrial building and a decline in residential building have been the principal features of the building activity of the first half of the current year. In New England the June building contracts were somewhat less than the May figures. In New York State and northern New Jersey, the figures, amounting to $69,439,000, showed an increase of 35% over those for May. The Philadelphia, Baltimore and Washington territory showed a slight decline, while the Pittsburgh district reported practically the same figures as in May. In the central West a 10% increase was reported, while in the Northwest there was a slight decline.

New York.—In an effort to meet the serious housing shortage in New York City, the Mayor's Housing Conference Committee has asked the State legislature to pass a law to stop the erection of office buildings and all non-essential buildings, until the crisis is met. It is announced that pledges have been forthcoming from some of the largest insurance companies and banks to make large loans for home building, so there will be no further difficulty on this score. The plan of the Housing Conference Committee is to secure from the lending institutions pledges for about 60% of the cost of the houses, the owners of the property to subordinate the land, valued at 20%, on first mortgage, and the employers to pledge the remainder, or most of it, so that their men may have homes built for them without investment on their part. A study by the committee of the rise in the cost of building materials shows that it has ranged from 10% to 366%. The increased cost of only one of the items out of the 115 is 10%; the majority of the articles have advanced over 100%. Twenty-six have advanced almost 200% since 1914, and 14 have risen over 300%. The percentage of increase in some of the principal building materials above the 1914 cost are as follows:

4-in. C. I. fitting, 351; 28 gauge galvanized sheets, 319; tiles, 200; hardware, 200; steel, 200; radiators, 250; fittings, 225; galvanized boilers, 254; Vermont marble, 200; slate, 200; electric lighting fixtures, 125; electric wiring materials, 125; sash, 100; sheet glass, 100; wire glass, 150; boilers, 160; pipe, 140 excavation, 100; Tennessee marble, 175; Italian marble, 125; cold rolled copper, 100; soft sheet copper, 100; wire glass sized, 191¼; ribbed glass, 181.

Detroit, Mich.—Attacks by union steam fitters and plumbers on workmen employed on fifteen new school buildings in Detroit have resulted in appeals for protection to the Board of Education from forty heating contractors. The contractors maintain that plenty of non-union are available. As a result of the long drawn out strike in the heating and plumbing industry, contracts on millions

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of dollars' worth of buildings in Detroit are at a standstill. Few new contracts are being let, the outcome of the present strike being awaited before new commitments are made.

William J. Olvany, New York, heating and ventilating contractor, has purchased a four-story brick building at 100 Charles Street, New York, where his business is now located. For twenty years Mr. Olvany has been in the contracting business in New York near his present quarters. The basement of the new building is devoted to a pipe-threading and pipe-cutting shop and is equipped with motor-driven machines. The main office is on the first floor.

Chicago Master Steam Fitters' Association held its sixth annual outing June 30, at Ravinia Park, on the north shore of Chicago. It required 75 automobiles, headed by a motorcycle policeman and Bredfield's Band, to take the party to the park. Outdoor sports were the order of the day, a snappy baseball game between the contractors and the supply men being won by the steam fitters to the tune of 9 to 7. The new officers of the association, elected at the association's annual meeting at the Hotel Sherman, June 22, are: President, H. M. Hart; vice-president, F. C. Black; secretary, Charles Glennon; treasurer, B. W. Brady. Directors: George H. Henrich, and W. E. Benoit. Board of Arbitration, W. A. Pope, George M. Getschow, W. J. Gemeny and R. T. Wray; alternates, T J. Monohan, E. J. Kohlbry.

Proposed Contract Provisions have been drawn up by the Committee on Contracts of the Associated General Contractors of America and are being sent out with an invitation for suggestions from members and others interested. In presenting the contract provisions, it is stated that an analysis of income tax returns shows that contracting is the most hazardous industry in the country. The amount of loss for every dollar of profit made by construction corporations is eight times as great as it is in manufacturing, agriculture, or personal service corporations; five times as

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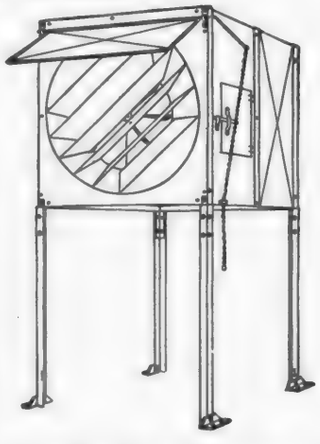
Less Costly to Maintain than Direct Radiation or Blast Systems

Particularly desirable for "Monitor or Saw Tooth" roof type of buildings. A correct solution for local cold spots or inadequate systems.

Exterior View of Monitor Type Building Occupied by Service Station Equipment Co., Chicago, Ill., Equipped with Ilgair Unit Heaters

Interior View of Above Building, Showing Ceiling Suspension Type of Ilgair Unit Heaters



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The Present Day Coal Situation Demands Heating Economy

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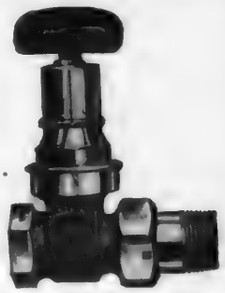

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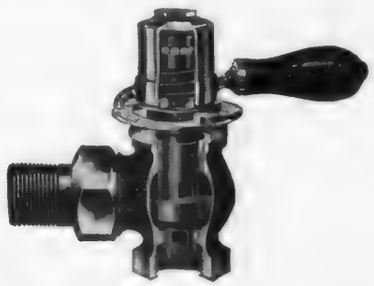

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On medium or low pressure steam and hot water lines, Asbestocel saves heat that escapes from bare pipes or through "ordinary" covering. Send for the booklet that describes how this saving is accomplished through the unique construction of Asbestocel, one of the Johns-Manville insulations.

How to select insulation

TEN years ago there may have been some reason for using inefficient pipe covering. Because then the exact science of insulation was undeveloped and there was little available data to prove one material or method better than another.

But insulation can now be selected with a clear understanding of the amount of heat it will save. For today, through exhaustive tests, the insulating value of practically every material and method of application is accurately known.

Johns-Manville publish data relative to insulating values, which are available to you in booklet form. Send for this information and use it as a basis in selecting the insulation best adapted to your requirements.

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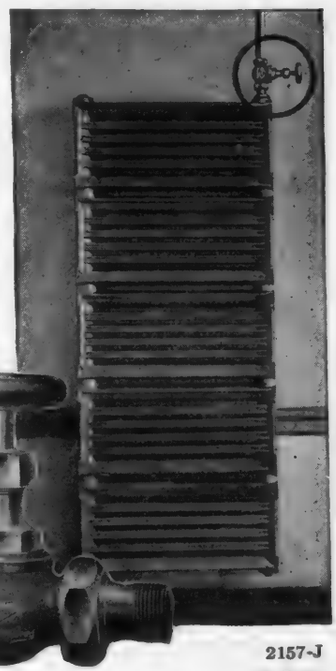
The Jenkins Renewable Disc gives the valve practically unlimited life.

Made in sizes to meet all heating requirements.

Genuine Jenkins Valves are obtainable at supply houses everywhere.



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New York Chicago
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Since 1864

great as in transportation and public utility corporations; over three times as great as in mining and quarrying; and nearly twice as great as in banking. The reasons for this condition are due to the unusual number of doubtful elements in construction with which a contractor must work. After studying 113 different forms of contracts of various types, the committee offers the following provisions and states that additional provisions will be offered from time to time:

1. Action on Bids. Bids should be submitted with the provision that they should be acted upon within a reasonable time.

2. Freight Rate Changes. Bids should be submitted on the basis of existing freight rates, with the provision that in case a change in rates should occur between the time bids are received and the date fixed for the completion of the contract, the contract price should be increased or decreased accordingly.

3. Wage Scale Changes. Bids should be stated and submitted on existing wage rates, with the provision that the contract price shall be increased or decreased in accordance with any change in such rates before the date fixed for the completion of the contract.

4. Material Price Changes. Bids should be submitted on the basis of existing prices for materials f. o. b. the producer's plant or distributor's yard, with the provision that the contract price shall be increased or decreased in accordance with any change in such prices that takes place within the time allowed the contractor to purchase and fabricate his materials.

5. Monthly Estimates. Monthly estimates should include materials delivered and suitably stored as well as materials incorporated in the work.

6. Partial Payments. Certificates should be prepared and delivered to the contractor between the first and tenth day of each month, showing the proportionate part of the contract price earned during the preceding month. These certificates should be paid by the owner by the tenth day of the month. Interest on deferred payments should be paid the contractor at the prevailing rate.

7. Contractor's Right to Stop Work. Under the following conditions the contractor should have the right to stop work or terminate the contract upon three days' written notice to the owner and the architect, and recover from the owner payment for all work executed and any loss sustained upon any plant or material and reasonable profit and damages:

(a) If the work should be stopped under an order of any court, or other public authority, for a period of three months, through no act or fault of the contractor or any one employed by him;

(b) If the architect or engineer should fail to issue the monthly certificate for payment in accordance with the terms of contract;

(c) If the owner should fail to pay the contractor, within seven days of its maturity and presentation, any sum certified by the architect or engineer or awarded by arbitration.

(d) If the owner does not permit the contractor to proceed with construction within a reasonable time after signing the contract.

8. Retained Percentage. The retained percentage should be based on 100% of the work performed and should never exceed 10%. When the amount retained reaches a total sum, which shall be mutually agreed upon by the owner and the contractor, no further reduction from payments should be made.

9. Surety Bond. Where a surety bond is given, it should be reduced at agreed intervals so as to cover thereafter only that portion of work then uncompleted.

10. Penalty Clauses. Wherever any provision is incorporated in the contract for a penalty against the contractor (including liquidated damages), there should also be inserted a provision for a bonus of like amount.

11. Acts of God or Public Enemy. The contractor should not be held liable for results arising from the acts of God or a public enemy.

12. Time Allowed for Completion of Work. The time allowed for the completion of the work should be based on "weather working days" instead of on elapsed time, and, if necessary, allowance should be made for time spent in performing unproductive work made necessary by floods or other natural causes beyond the control of the contractor.

13. Inspection. Where practicable, ma-

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   The Whitlock Feed Water Heater saves 13% of the coal burned under the boiler.
2. **TO INCREASE THE *CAPACITY* OF THE BOILER.**
   The boiler gains 13% capacity when used with a Whitlock Feed Water Heater.
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   Where a Whitlock Heater is used, there are no "local strains."

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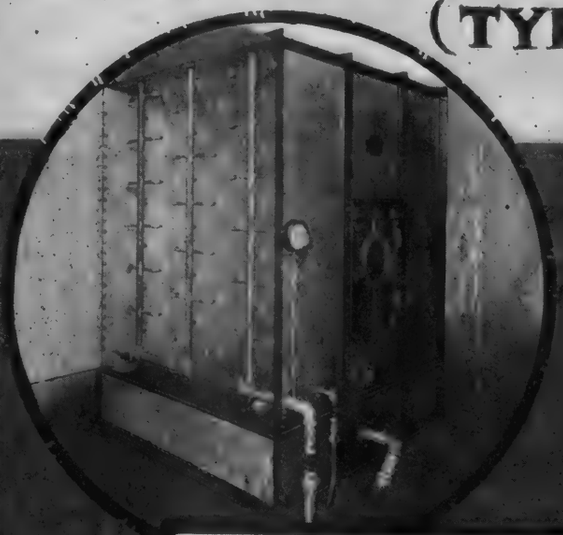

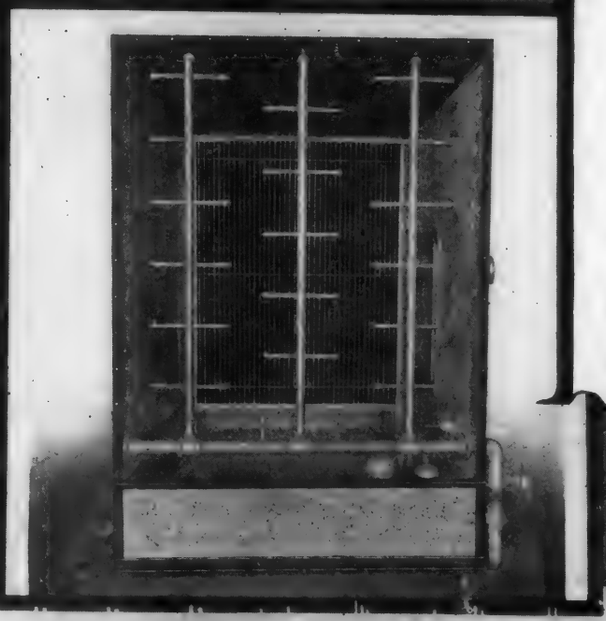

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The SPRACO CENTER JET NOZZLE presents a dense, massive spray blanket which is absolutely impenetrable to all solid particles or soluble gases present in the air.

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Mfgrs. also of Spraco Cooling Ponds, Spraco Paint Guns and Cement Sprayers, Spraco Nozzles, Vaughan Flow Meters, etc.

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terial should be inspected at the source so that costly delay may not result from the rejection, at the site of the work, of materials furnished in good faith by the contractor.

14. Force Account Work. Payment for force account work should be made on the basis of the total actual costs of the work, including the actual labor and material costs, rental on equipment, liability insurance, etc., plus a reasonable percentage to cover overhead and profit, total to be not less than 15%.

15. Change in Quantities. In case the actual quantities of any item in a unit price contract are less than the estimated quantities by more than a certain fixed per cent, the unit price paid the contractor for that item should be increased by an amount to be agreed upon. Similarly, a decrease in the unit prices should be made in case the quantites are increased over the estimate by more than a certain fixed per cent.

16. Arbitration. In no case should the engineer or architect be made the final judge as to the interpretation of the drawings and specifications or the performance of the contract. All decisions and interpretations should be subject to prompt arbitration at the choice of either party to the dispute.

Manufacturers' Notes.

Haynes Selling Co., Philadelphia, Pa., manufacturer of heating specialties, has appointed E. A. May manager, with headquarters at 327 South La Salle St., Chicago.

Sims Co., Erie, Pa., is completing an addition to its plant which will permit a great increase in its capacity. The company is also building a new foundry which will be ready for operation by October 1.

Ludlow Valve Mfg. Co., Troy, N. Y., manufacturer of high-pressure valves, hydrants, etc., has increased its capital stock from $1,000,000 to $1,300,000.

Crane Co., Chicago, Ill., will build a new pipe shop at 24th Street and Allegheny Valley Railroad, Pittsburgh.

Northern Heating & Engineering Co., Portland, Me., dealing in heating, plumbing and cooking appliances, has opened offices and display rooms at 271 Middle Street and 246 Federal Street, Portland. F. William Eichholtz, formerly with the engineering department of a furnace company, is in charge of the engineering department. Harry Eastman formerly head of the T. F. Foss & Sons Stove Company and the Portland Stove Foundry Company, is in charge of the service department.

Syracuse Vapor Heat Co., Syracuse, N. Y., manufacturer of heating devices, has increased its capital stock from $40,000 to $75,000.

Buffalo Forge Co., Buffalo, N. Y., held a convention of its engineering and sales force June 22-25, at the company's plant in Buffalo. A number of papers were read, including the following:

"The Design of Galvanized Ducts with Special Reference to Factory Heating," by L. C. McClanahan.

"The Buffalo-Klein System of Heating," by H. F. Gremmel.

"The Dryjector,' by B. R. Andrews.

"Types and Characteristics of Multiblade Fans," by C. A. Roth.

"Sewage Pump Installations," by H. P. Gant Philadelphia.

"Buffalo Apparatus in Paper Mills" by Robert W. Pryor Jr.

In addition an interesting paper was presented by Miss Lillian Green of the bookkeeping department on "The Proper Distribution of Commissions."

Central Station Heating Notes.

Carrollton, Ill.—The action of the State Utilities Commission in granting permission to the Central Illinois Public Service Company to discontinue its steam heating service in Carrollton has been set aside in the circuit court by Judge E. S. Smith, on the city's appeal. The company had claimed that the system was operating at a loss. It is stated that the company will now appeal from the decision of the circuit court.

Danville, Ill.—Steam heating rates in Danville will remain unchanged until December 22, according to a rule made by the State Public Utilities Commission. "The company asked for the continuance" said J. E. Johnson, general superintendent of the Danville street railway and light company, "In order to see

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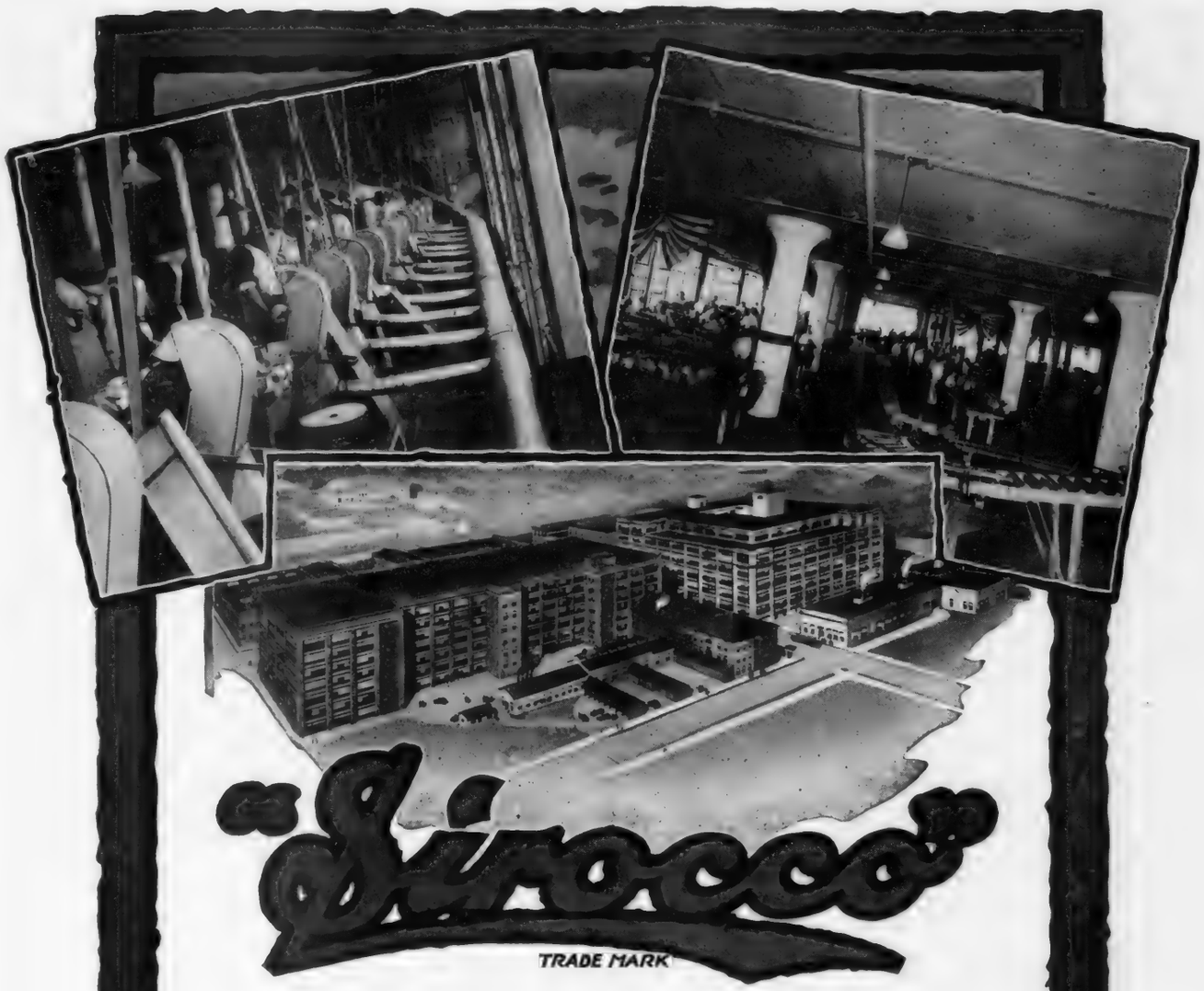

In Industrial Plants

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At the Delco Plant, Dayton, Ohio, two systems are in use. In one department Sirocco Exhaust Fans are used to carry away dust from the buffing wheels. In another department Sirocco Fans furnish clear, fresh air, keeping the department in just the right condition for best results. Today greater attention is being given the ventilating question than ever before.

If you are working on a particular problem in which Sirocco equipment is being considered, one of our sales engineers, located near you, will be glad to talk over the proposition with you.

AMERICAN BLOWER COMPANY
Detroit, Michigan

whether or not the company would be able to get along under the old schedule of rates." Advanced rates, previously filed, were re-suspended until that date. Other cities affected by the ruling of the utilities commission are: Decatur, Clinton, Bloomington, Galesburg, Urbana and Champaign.

Decatur, Ill.—The Decatur Heating Company has certified to a decrease in its capital stock from $100,000 to $5,000. The company is one of the subsidiaries of the Illinois Traction System, which has already decreased the capital stock of all of its subsidiaries in Jacksonville.

Aledo, Ill.—The hearing on increased rates for heating in Aledo was scheduled for July 14, after having been set for June 17. The proposed rates represent an increase of approximately 76%. Several business men, it is announced, are making preparations for installing private plants. Although the Northern Utilities Company has a franchise calling for two years more of heating service, it is stated that a number of the local consumers will withdraw this Fall.

Belvidere, Ill.—The Belvidere Heating Company, which proposes to build a plant for furnishing steam heat to business places and residences from a central plant, has bought a site for its boiler house at Meadow and Whitney Streets. This is directly across Whitney Street from the city water works, from which pipes can be run to carry waste steam from the city plant. Bids have already been received for the construction of the boiler plant which will be equipped with a stoker and a smokestack 150 ft. high.

St. Louis, Mo.—Hearings are being held on increased rates asked for by the Union Electric Light & Power Cmopany on its steam heating service. The proposed schedule affects 140 customers, including downtown hotels, office buildings and mercantile establishments. The company has been charging an average rate of 57.6 cents per 1000 lbs. of steam furnished and now asks for $1.02. The increase, if granted, would add approximately $311,000 per year in revenue. It was stated by Louis H. Egan, president of the company, that the company's total revenue from this character of service last year was $412,000 and that it represented a loss to the company. Even with the increase asked for, he said, he did not think the company would make any profit on the steam heating plant service. Future increases in the cost of coal and the fact that labor costs more than it ever did, he said, were to be taken into consideration.

Sedalia, Mo.—The Economy Steam Heating and Electric Company has applied to the State Public Service Commission for permission to dissolve the corporation and discontinue operating the plant for furnishing heat to buildings in Sedalia. In its several years' service, it is claimed, the company has sustained a loss of $100,000.

Madison, Wis.—Complaints filed by the Wisconsin-Minnesota Heat and Light Company, asking that the State Railroad Commission be restrained from enforcing existing rates, has been dismissed on the ground that the complaint was too general. It was held that exact information should be given on the resources of the plant, including the income and operating expenses. The present heating rate of the company in La Crosse is 19 cents per 1000 lbs. of condensation and it was proposed to increase this rate to 30 cents. It was claimed by the company that the rates allowed by the State board are confiscatory and that the penalties are severe and deny the utility equal protection under the law.

Grand Rapids, Mich.—Mayor John McNabb has been notified by the Windsor Central Heating Syndicate of Windsor, Ont., that it will send representatives to Grand Rapids shortly to consider the organization of a local company to operate a central station heating system and to negotiate for a franchise. In its letter to the mayor, the company states that it has been approached by a number of prominent citizens in Grand Rapids who have urged it to establish an underground heating system in Grand Rapids similar to that for which a franchise is now pending before the Windsor city council.

Bloomington, Ill.—A plan is under consideration in San Jose for furnishing steam heat from the electric light plant of F. B. Hullinger, which now furnishes electric current to San Jose

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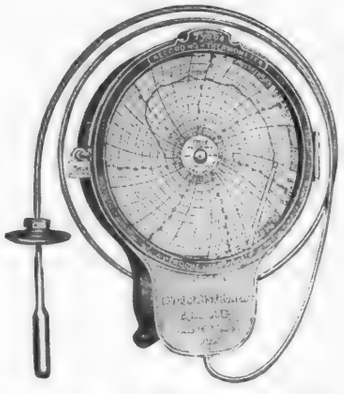

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Tycos Recording Thermometers will give you those correct temperature records you want at many places in the boiler room.

Our many years experience means that the highest thermal skill is applied to the solution of your temperature problems if they are solved the Tycos way.

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Buffalo-Klein System

See page 29

The Buffalo Forge Company announces that it has acquired the United States and Canadian Klein Patents.

Consider the Buffalo-Klein System before specifying your heating and ventilating equipment.

Buffalo Forge Company

BUFFALO, NEW YORK

"Buffalo"

and Delavan. The plant also does the pumping for the city's water plant.

New Ulm, Minn.—Figures on the operation of the central steam heating plant in New Ulm, prepared by a joint and the business men and citizens who committee representing the city council furnished the money to build the system, show that the plant will have paid for itself in three more years. The system was built five years ago, the money being secured through the sale of stock paying 6% interest. When the profits from the plant have paid for it, the city is to take over the plant and operate it as a public untility. The original cost of the plant was $43,637. Increased costs would made the cost much higher than that today. In the first season the total income was $4,275, and the net earnings were $2,652. Both receipts and net earnings increased from year to year and in the fourth year the receipts were $11,165 and the net earnings $6,962. During that same period there was placed in the depreciation fund the sum of $6,253.

These figures show that in the four years the plant has operated there has been paid back to the investors the sum of $19,269, and the expectation is that in three more seasons the total investment will be paid and that the plant will be turned back to the city with an accumulated depreciation reserve fund of approximately $13,000. The total cost of live steam used during the four seasons is estimated at $4,000 and the total income has been $33,072. The books of the concern are audited each year by a joint committee representing the stockholders and the city. The report of the auditing company for the season just closed provided that $2034 be put into the sinking fund and that $9,130 be applied to the reduction of the purchase price of the plant, the remainder of the receipts being used for expenses and interest.

New Incorporations.

Lincoln, Andrew & Lane, Pawtucket, R. I., capital $100,000, to conduct a heating and plumbing business. Incorporators: Edward H. Andrew, Pawtucket; James P. Lincoln and Roland P. Lane, both of Providence.

Cole-Phelps Heating Co., Holyoke, Mass., capital $50,000. President, Edwin Q. Cole; treasurer, John P. Phelps, 137 Pleasant St., Holyoke; clerk, M. D. Pomeroy.

Libby & Blinn, Inc., Hartford, Conn., has been incorporated with a capital stock of $75,000, to take over the heating and plumbing business of Libby & Blinn. Incorporators: L. R. Libby, A. L. Shipman and P. W. Miller, all of Hartford.

New Firms and Business Changes.

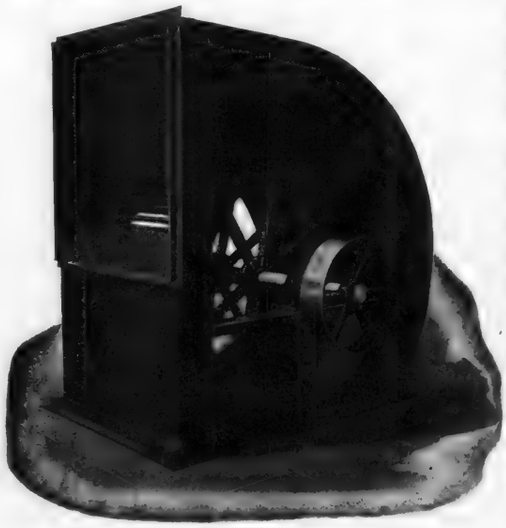
Crowell & Smith Co., Cleveland, O., heating and ventilating contractor, announces the removal of its office, warehouse and shop to the company's own building at 1409-1419 St. Clair Avenue, Cleveland.

New York—Formal announcement has been made of the consolidation of Westinghouse, Church, Kerr & Co., Inc., and Dwight P. Robinson & Co., Inc., under the name of Dwight P. Robinson & Company, Inc. The company, whose offices are at 125 East 46th Street (with a downtown office at 61 Broadway) describes its activities as "engineers and constructors." The officers are: President, Dwight P. Robinson; first vice-president, T. N. Gilmour; vice-president, I. W. McConnell; vice-president and treasurer, A. K. Wood; vice-president, R. M. Henderson; vice-president, L. H Bean; vice-president (Chicago office) H. H. Kerr; secretary, W. L. Murray. Directors: Paul D. Cravath, Thomas N. Gilmour, Homer Loring (Loring & Co., Boston), Ira W. McConnell, John P. McGinley (chairman Chicago Pneumatic Tool Company), Harry T. Peters (president The Fairbanks Company), Dwight P. Robinson, Edward R. Tinker (vice-president, Chase National Bank), and Arthur King Wood.

Douglas Sprague and Chester A. Slocum, associate consulting engineer New York, announce that they are now located at 167 West 13th Street, at Seventh Avenue and 13th Street. The firm renders expert services in ventilation, sanitation, heating, electrical work, power plants, together with reports and valuations.

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



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BUCKEYE BLOWER CO.

COLUMBUS OHIO.

Sturtevant
PUTS AIR TO WORK

Amicable Life Building, Waco, Texas
SANGUINET AND STAATS, ARCHITECTS
J. A. OSBORNE, ENGINEER

Oliver Hotel, South Bend, Indiana

Empress Theatre, Sacramento, Calif.

WHY DOES MANUFACTURER RESEARCH DETERMINE CONTRACTOR SUCCESS?

Have you ever been disappointed with your heating and ventilating jobs because the volumes and capacities of fans failed to meet your specifications?

Engineers and contractors *do* experience such situations and usually it is because they have specified or bought apparatus minus—manufacturer research and engineering.

Assurance of the success of a job rests in constant research and attention to manufacturing detail. Any amount of effort exerted by the engineer or contractor cannot overcome errors made in manufacture. It is apparent, therefore, that installation success is the outcome of constant research plus well-made apparatus, the real merit of which is proven by year in and year out performance.

In all classes of buildings and under all conditions of operation Sturtevant systems prove successful. We manufacture heating and ventilating equipment suitable for dairy lunch or skyscraper with equal attention to the requirements of either.

Consult any one of our sales-engineering branches or write to Hyde Park for literature, stating the class of building you are interested in.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASSACHUSETTS
AND ALL PRINCIPAL CITIES

West High School, Cleveland, Ohio

Unitarian Church, Cleveland, Ohio
BRIGGS AND NELSON, ARCHITECTS

Mechanical Engineering & Supply Company, Inc., Sacramento, Cal., has entered the building field, specializing in heating and ventilating public and private buildings. The firm was recently awarded a contract for installing the heating and boiler plant in the Fresno High school, and heating systems in the Jefferson and Edison schools. J. B. Hawley, member of the company, is a graduate of the University of Illinois and was formally mechanical engineer for the State Department of Engineering. L. B. Luppen, the other active member of the firm, is a graduate of Cornell University and for the past two years served as chief engineer in the State Department of Engineering, Sacramento. Mr. Luppen was identified with the State for eight years and prior to that time was with the Mechanical Engineering Department of the City of San Francisco, and was engaged in work on the Hall of Justice and Palace Hotel.

Contracts Awarded.

Jamestown, N. Y.—The bid of Warren Construction Company for labor and material in building the new heating plant for the Jones General Hospital in Jamestown, were accepted. It was $15,800. The heating system will be installed by Chatfield and Sharp, at their bid of $4809 (not including underground work). The cost of the underground work will amount to $2900 and will also be done by Chatfield and Sharp.

Olean, N. Y.—Heating plant contracts for five of Olean's public schools have been awarded. The contract for the heating apparatus in the High School, and Schools 2, 3, 4 and 7 was awarded to the Power Efficiency Corporation of Buffalo at its bid of $148,201. The only other bidder was the John W. Danforth Co., of Buffalo.

Columbus Heating & Ventilating Co., Columbus, O., installing warm-air heating and ventilating plant on the Bucyrus High School for $55,000; also warm-air heating high school at Indiana, Pa., for $15,000, and junior high school at Donora, Pa., for $10,000.

Organization of International Chamber of Commerce.

Permanent organization of the International Chamber of Commerce was effected at the recent meeting in Paris which was attended by 500 delegates from the five countries that participated last Fall in the International Trade Conference. Among other things taken up at the organization meeting was the restoration of international credit and the establishment of an international credit bureau.

Etienne Clementel, former Minister of Commerce in France, and a member of the Supreme Economic Council, was elected president. The directors representing the United States are: John H. Fahey, formerly president of the United States Chamber of Commerce; Willis H. Booth, vice-president of the Guaranty Trust Co., of New York; and Edward A. Filene, president of William Filene's Sons Co., Boston. The alternates are: Harry A. Wheeler, former president of the United States Chamber of Commerce; William Butterworth, and owen D. Young, vice-president of the General Electric Company.

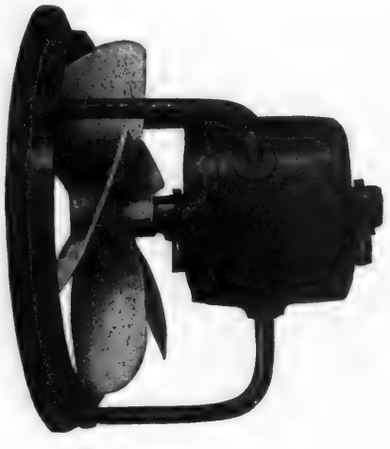
The next meeting of the International Chamber will be held in London next June. Temporary headquarters have been established in Paris.

Growth of the Chicago Pump Company.

From an obscure beginning in a small store at Fulton and Curtis Streets, Chicago, to a modern manufacturing plant, within a period of ten years, is the record of the Chicago Pump Company. The company's success is attributed to the fact that it was founded and is operated by men who have made the manufacture and sale of pumping machinery their life work. The company owns its new building at 2322 Wolfram Street, which covers 25,000 sq. ft. of floor space. The firm has also purchased 30,000 sq. ft. of ground adjoining the present building on which it expects to erect an addition shortly.

In the new plant many improvements have been added to the company's manufacturing processes. For instance, in the manufacture of bilge pumps,

"WING-SCRUPLEX" RELIABILITY



When you select a certain "WING-SCRUPLEX" Fan from our catalog to deliver a given number of cubic feet of air per minute, you get all that is promised—and more—That's RELIABILITY.

Every time you specify or install a fan, your reputation is at stake—"WING-SCRUPLEX" Fans protect that reputation.

Besides this you are absolutely protected on price. That is the commercial end of it, and is of interest to you, of course.

It is our business to manufacture these products, and your business is selling and installing such things. Therefore, you must have RELIABLE price protection.

L. J. Wing Mfg. Co.

Hudson and 13th Streets
N. Y. CITY

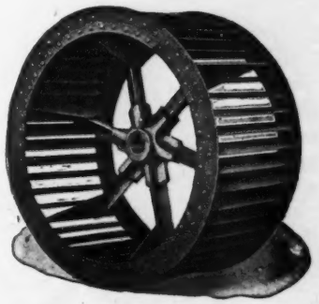
CAPITOL THEATRE NEW YORK

IN this the most modern and up-to-date and perhaps the finest theatre of its kind in the world,

Massachusetts Fans

were selected to take care of the fresh air supply and exhaust systems. Seven large "Squirrel Cage" fans and two Massachusetts Davidson propeller fans were installed, the four main fans supplying and exhausting respectively 140,000 cubic feet of air per minute, while the smaller fans exhaust 20,000 cubic feet of air per minute from the lavatories, smoking room, etc. One hundred horse power is required to operate the plant.

Where may we send you ALL the facts on MASSACHUSETTS FANS?



MASSACHUSETTS BLOWER CO.
WATERTOWN, MASS.

work pits have been constructed in which the pump can be placed in a vertical position and the motor properly mounted on the floor plate. Work pits have also been provided alongside of the radial drill presses so that the long pump stems may be drilled accurately after having been made up, and proper alignment assured.

An elaborate testing department has been installed for testing each pump before it is shipped. Each pump is tested at the capacity at which it is to operate. The amount of water which it is handling is measured, and the amount of current that it takes to operate the outfit is also measured and a permanent record made of the test. These records are filed and cross-indexed, so that they may be easily located by the number which each outfit bears, the building in which it is installed, or by the name of the original purchaser of the outfit. Special attention has been given to the packing and crating department, so that shipments will reach their destination in first-class condition.

The factory is entirely a daylight plant, no artificial light being used at any time of the day. A ventilating system is installed, supplementing a carefully-designed heating system.

The vacant ground adjoining the plant has been fitted up as a baseball diamond for the recreation of the men during the noon period and before and after working hours. The factory is located in a residential section of the city, away from the congestion and noise, assuring quiet as well as good air conditions.

NEW PLANT OF CHICAGO PUMP CO

Pratt & Cady, Inc., Hartford, Conn., has issued a new booklet on Davis hot water service heaters. The company will be glad to send a copy to anyone interested.

WANTED

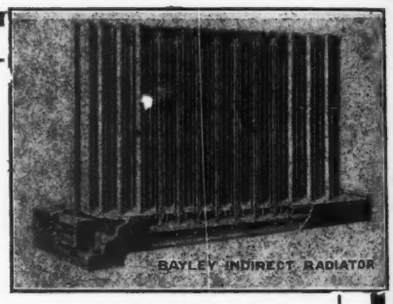
Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisements contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Position Wanted—Englishman desires start in New York City. Seven years' estimating experience with London heating engineers. Address Box 52, care of HEATING AND VENTILATING MAGAZINE.

Wanted—Have opportunity for unlimited advancement with large heating engineering and contracting organization for several young men, preferably with some drafting experience, but particularly experience in estimating heating and power work. Write, giving full particulars as to age and experience, locality preferable and salary expected. Address Box 18, care of HEATING AND VENTILATING MAGAZINE.

Simplify Your Heating, Ventilating and Drying Problems

by letting our engineers furnish you with plans, specifications and give you the benefit of their many years of practical experience on problems similar to yours.



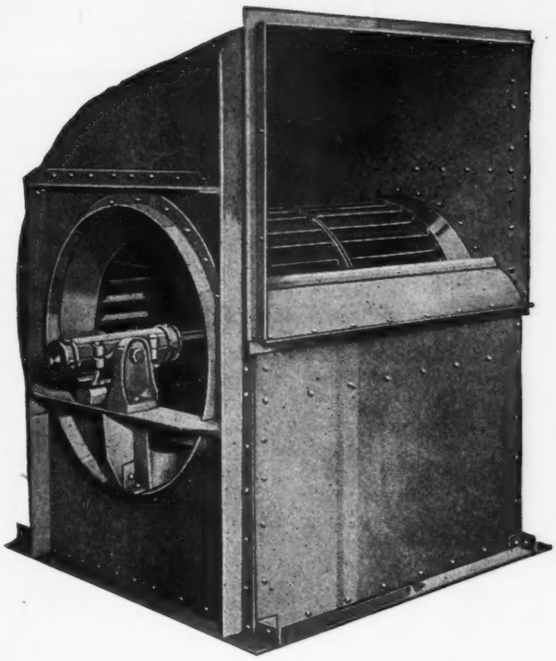
CHINOOK HEATER

Bayley Chinook Heaters and Plexiform Fans

are the result of the practical application of a thorough knowledge of heating and ventilating requirements. The Chinook is the only heater that can be repaired without taking down the entire section, and the only one that can be shipped "Knock-down." Plexiform Fans are designed for durability, efficiency, ease of operation, and are accurately balanced.

Full information of these and other Bayley specialties free on request.

BAYLEY MFG. CO.
MILWAUKEE, WIS.



Cut shows double width double inlet
SERI-VANE FAN TYPE C
full housed overhung pulley

Seri-Vane Fans

Write for our latest catalogue Number 70 describing our

Seri-Vane Fans Type C

A special SERI-VANE FAN is made just for that fan problem you have.

We specialize in complete installations for the drying of brick, lumber, powder, gelatine, glue paper, leather, etc.

THE NEW YORK BLOWER COMPANY
51 Transportation Bldg.
CHICAGO, ILL.
Factory - LaPorte, Ind.
Branch offices in all large cities.

Pat'd May 26, 1908

CYCLOIDAL MULTIVANE FANS

FULFILL THE ENGINEERS' OBLIGATION TO THE USERS

EFFICIENT — NOISELESS — DURABLE

Built along scientific lines—of high grade materials and best of workmanship. This coupled with our forty years experience in the manufacture of fans of all types—GUARANTEES

PERFECT SATISFACTION

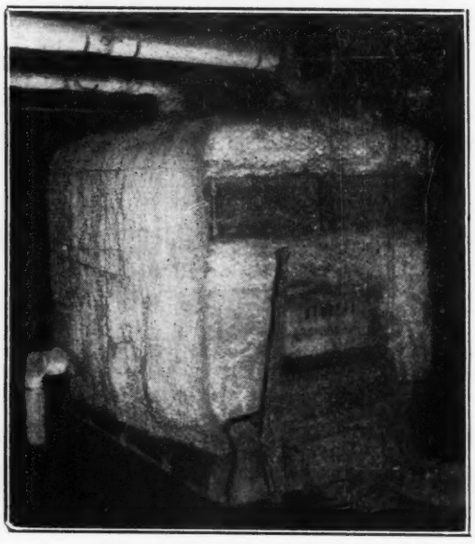
SECTIONAL CATALOG NO. 120
CONTAINS CAPACITY TABLES,
DIMENSIONS AND FURTHER
DETAILS

Garden City Fan Co.
Est. 1879
CHICAGO, ILL.

THE MARK OF HIGH EFFICIENCY
Cycloidal

Banner Rock Wool Quilt
100% Fire Proof

INSULATION
FOR
HOT SURFACES



Cut shows typical installation of Banner Rock Wool Quilt on Boiler of Apartment House after 4 Years' Service

DISTINCT ADVANTAGES.
BY GOVERNMENT TESTS THE

1 MOST EFFICIENT
2 EASE OF APPLICATION
3 FLEXIBILITY
4 CAN BE TEMPORARILY REMOVED TO MAKE REPAIRS
5 LOWEST INITIAL COST

"More Insulation for Money Invested"

Send for Information

Banner Rock Products Co.
Alexandria, Ind.

Data Needed on Steam and Return Pipe Sizes.

In a report discussing the data needed by engineers on steam and return pipe sizes, James A. Donnelly, chairman of a committee to gather such data, states:

A broad division should be made in discussing steam main sizes. The first division covers the distribution of the steam and the second, its use. The conveyance of steam for any considerable distance is a problem by itself. Steam flow tables should be used, but when it comes to sizing the pipe within the buildings, tables giving the capacities of steam mains and branches, radiator connections, etc., are needed.

There is no formula available for estimating the friction drop of mixtures of steam and condensation or water primed from the boiler. Excessive moisture in the steam or boiler priming may so increase the drop in pressure that an entire failure in operation may result. It is, therefore, good practice to provide hand holes or equivalent cleaning means at the bottoms of all boilers, and a permanent surface blow-off, for boiling off the boiler, so that clean water and dry steam may be always maintained.

Steam mains should not be dripped on the main trunk lines and the riser connections and laterals pitched back to the mains. Much better results are obtained by dripping the mains to take care of their condensation and then pitching the riser connections, and laterals to first floor radiators, away from the main and providing added drips to take care of their condensation separately. No branch or lateral larger than the supply to a single radiator should be pitched back against the flow of steam and if it is not certain that the velocity is below the critical limit, the pipe should be provided with a separate drip.

Water of condensation collecting in the laterals and surging up and down in the steam risers and radiator connections is the cause of more poor circulation than any other single factor in pipe design. Its presence can usually be detected by a tele-microphone or the application of a compound recording gauge which will show an intermittent of jagged record of pressure.

Interstate Commerce Commission Needs Engineers.

For the work of expediting the valuation of common carriers, the United States Civil Service Commission states that the Interstate Commerce Commission needs architects and engineers (civil, mechanical, electrical, structural signal telegraph and telephone). These men will be used for office work in the computation and assembly of the large amount of data which has been furnished by the field engineers. Senior architects and engineers are offered entrance salaries form $2100 to $2700 a year; junior engineers, $720 to 31920; junior architects, $1320 to $1920. A daily allowance is made for subsistence, as well as transportation expenses, when away on official business, and an increase of $20.00 a month granted by Congress is offered. The Civil Service Commission will receive applications for these positions until further notice.

PECO

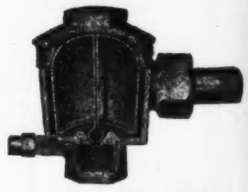
"The System with a Record"

Over thirty plants "Pecoized" for one company

20% to 40% fuel saving

Let us talk over your condition with you

The Fool-Proof Valve



Non-adjustable Positive in action

Catalog on request

PITTSBURGH ENGINEERING CO.
Mfrs. Peco Vacuum System of Steam Heating and Drying
JEANNETTE PENNSYLVANIA